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The Geographical Journal

INCLUDING THE PROCEEDINGS OF THE ROYAL GEOGRAPHICAL SOCIETY.

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The
Geographical Journal.

No. 3. MARCH, 1905. Vol. XXV.

FROM SRINAGAR TO THE SOURCES OF THE CHOGO LUNGMA GLACIER.*

By WILLIAM HUNTER WORKMAN, M.A., M.D., F.R.G.S., Member Alpine Club, Charter Member American Alpine Club.

It was my fortune to spend the summers of 1902 and 1903 in exploring, with Mrs. Fanny Bullock Workman, the hitherto unvisited upper portions of the Chogo Lungma, Hoh Lumba, Sos Bon, and Alchori glaciers. We were accompanied, in 1902, by the guide Mattia Zurbriggen and porter Giuseppi Muller, of Macugnaga, and in 1903 by the guides Joseph Petigax and Cyprien Savoie, with Laurent Petigax as porter, all of Courmayeur, who were engaged and sent to us in Kashmir by Signor Francesco Gonella, president of the Turin section of the Italian Alpine Club, and Signor Ettore Canzio, of Turin, well-known Italian alpinists, to whom we are greatly indebted for their prompt and friendly assistance. We had with us, also, in 1903, Mr. B. H. M. Hewett, of London, as topographer.

I invite you to revisit with me to-night that portion of our route, which lay between Srinagar and the sources of the Chogo Lungma, noting as briefly as possible some of its most salient features.

The Chogo Lungma, one of the largest of Himalayan glaciers, lies in the northern part of Baltistan, its termination or snout being just above the village of Arandu, in lat. 35° 52′ N. and long. 75° 23′ 40″ E., twenty-three marches north of Srinagar, the capital of Kashmir. It is best reached from Srinagar *viâ* Skardo, the chief town of Baltistan, and thence up the Shigar and Basha valleys.

* Read at the Royal Geographical Society, November 21, 1904. Map, p. 352. The map is based on theodolite survey by Mr. Hewett, corrected and supplemented from observations and photographs by Dr. William Hunter Workman and Mrs. Fanny Bullock Workman.

Several routes lead from Srinagar to Skardo, the shortest in twelve marches being up the Gilgit road to the Burzil Chowki and thence over the Deosai Plains. This route, owing to the elevation of the Deosai Plains, between 12,000 and 13,000 feet, and that of the Burji La, nearly 16,000 feet, is only free from snow and available for travel during July, August, and the first half of September.

The longer, more disagreeable, but more convenient and generally used route, because open the greater part of the year, takes one in eighteen marches up the Sind valley, praised for its scenery by summer visitors who have never been farther afield and beheld the supreme majesty of the wilder regions beyond, over the Zozi La, a low pass of about 11,000 feet to Kharbu, and thence down the valleys of the Dras and Indus.

The Dras and Indus valleys are dreary and desert, being walled in on both sides by high mountain barriers of scarred and gullied clay, crumbling granite, and shale, without vegetation, except here and there the aromatic shrub called boortsa and wild rose trees, which will flourish where nothing else will grow, and which often bear such a profusion of blossoms as to hide their stems entirely from view. They flash up in the stony wilderness like marvellous colour gems, each tree or group brilliant with every shade of mauve from the palest pearl to deepest crimson.

The path here is narrow and rough, running up and down steep ragged inclines, across gorges swept by mountain torrents, through stretches of soft sand, and over narrow ledges projecting from perpendicular rock walls which overhang rushing rivers beneath. Every 5 or 6 miles, usually at the entrance of side valleys, the landscape is varied by oases perched on the mountain flanks, or nestling at the bottom of the valley by the river-bank, beautiful in their bright spring green, or later, with their golden harvest, in striking contrast with the brown barren surroundings. The eye, wearied with the dull monotony of the chaos of rock and *débris* through which one has been passing, rests with delight on the terraced fields of waving grain, bordered by a profusion of mulberry, apricot, pear, walnut, poplar, and willow trees.

In the centre of the oases stand villages of a size proportioned to each, by the industry of whose inhabitants these gardens in the desert are created. Every available bit of alluvium among the rocks is cultivated, and good-sized terraces, bearing excellent crops, are seen, the alluvium of which has been brought in baskets from wherever it could be found in the neighbouring wilderness.

These oases are of artificial creation. The land on a sloping surface is built up in terraces, one above the other, retained by stone walls. A mountain torrent near by, which furnishes a never-failing supply of water, is tapped at a point above, and a canal constructed from it to carry the water along the upper side of the land to be reclaimed.

FIG. 1.—TYPICAL VIEW IN THE INDUS VALLEY NEAR TOLTI. PATH SEEN AT EXTREME RIGHT.

FIG. 2.—OASIS ON TALUS. WATER CANAL BORDERED BY TREES ABOVE. TO RIGHT, GORGE THROUGH WHICH WATER IS BROUGHT. IN FOREGROUND RIVER WITH HIGH BANK.

Openings are made in the canal walls at desired points, and the water is distributed as required over the whole series of terraces from top to bottom.

Oases like these, which form the homes of the greater part of the population of the mountain valleys, depend for their existence entirely on irrigation. Cut off the artificial water-supply, and they would become as arid as the desert wastes around them. The semi-barbarous Himalayan valley-dwellers, who in their habits are but little above their domestic animals, are experts in the art of irrigation, and have nothing to learn in regard to it from Western civilization. Their implements are simple, their methods of construction rude, but they apply the means at their disposal to the desired end in a manner absolutely scientific, and the results show their skill to the confines of the oases.

It is marvellous to see what crops are obtained from land that is often sandy and stony. Such luxuriant grain-fields I have seldom seen elsewhere. One is at first surprised at such results when one considers that these lands have been constantly under cultivation probably for untold thousands of years, that the cultivators have not at their command manure and other fertilizers such as are used in Western lands, and that they harvest their grain by pulling it up by the roots, thus leaving nothing in the ground to nourish future crops.

A little observation reveals the secret of their success. The sediment brought down from the mountains in the water of the streams is a potent fertilizer, which is kept constantly applied to the crops from the time they are planted till they are ripe for the harvest, so that the ground is continually enriched rather than exhausted.

One of the most interesting features of the Dras and Indus valleys is the evidence of water-erosion everywhere to be seen. Not only near the present level of the rivers, but at all elevations, even to the mountain-tops several thousand feet above, the granite rocks are smoothed, rounded, eroded in every conceivable manner and dented with pot-holes, showing that at some distant period they were subjected to the action of moving water carrying stones. Boulders of various sizes are strewn about at all levels, honeycombed in the most remarkable way, some being mere shells eroded both outside and inside.

From the shapes and positions of the pot-holes and erosions, it is evident that the direction of the currents that produced them was about the same as the flow of the two rivers at the present time. The erosions are seen mostly on the left banks of these rivers or west sides of the valleys, which slope away from the rivers much less precipitously than the right or east sides. The explanation of this, as well as the question whether the erosions were made at the levels where they now stand by water flowing thousands of feet above the present rivers, or at or near the river-levels and afterwards pushed up with the mountain

masses, I leave to those better equipped with geological knowledge than myself.

Skardo is situated in an amphitheatre among the mountains at the point of entrance of the Shigar into the Indus river, and is surrounded by imposing peaks. It is the most important town in Baltistan, being the seat of residence of the Tehsildar, and possessing a post-office, telegraph-office, sub-treasury, and bazaar. The Government maintains a meteorological station with mercurial barometer and other instruments, the readings of which at 8 o'clock a.m. are daily forwarded to the meteorological office at Calcutta. During both our expeditions to the Chogo Lungma and adjacent glaciers in 1902 and 1903, this served as our lower station for the calculation of altitudes, and the Government official kept a daily record of readings at 8 a.m., 12, and 3 p.m. for us.

A short distance above Skardo the Indus is crossed in a flat boat, and a large basin several miles in diameter, surrounded by mountains and deeply covered with sand, has to be traversed. The wind-storms, which rage here almost daily in the afternoon, have driven the sand into a series of remarkable sand-dunes. These take the shape of long elevated ridges and hillocks, surmounted by sharp arêtes and curling crests, some of which strongly resemble snow-cornices. I could not perceive that these last actually overhung the perpendicular, though I suspect they do when formed in damp weather, the overhanging portions afterwards crumbling and falling when dried by the burning sun, as loose sand was seen on the leeward slopes just below the sharp edges.

The sand acts like snow under the influence of the wind, and the result here was an exact counterpart of a high snow region exposed to strong winds. The tops of the highest of these hills and ridges must have been 300 feet or more above the general level of the basin. They were composed of fine white sand, whilst the lower slopes consisted of coarse sand driven into wavelets 3 or 4 inches deep, and from 3 to 12 feet in length.

From here the route leads up the wide Shigar valley, with its constant succession of villages situated on fertile alluvial fans, which radiate from the openings of the gorges cleaving the mountain barriers on either side. The Shigar valley is renowned for the quality of its apricots and mulberries, which are delicious, as well as for the abundance of its grain. The village of Shigar is the principal grain depôt of this region, and there we purchased the large supply of ata, or meal —some 4 tons—which in 1903 was required to feed the eighty-five coolies who accompanied us. The ata, which had to be forwarded in skin sacks eight to ten marches to us, shrunk about 20 per cent. in bulk at the hands of the coolies who carried it. As we paid for it in advance when ordering it, the burden of this shrinkage fell upon us, and not, as should have been the case, on the official who agreed to

deliver it under seal. One finds human nature much the same in all parts of the world. Some of the devices resorted to by these primitive Asiatics to overreach would do credit to the ingenuity of their more civilized neighbours of the western world.

In order to reach the Basha valley, at the head of which Arandu lies, a series of rushing, mud-laden streams, which anastomose with one another along the valley bed, has to be crossed. The passage of these is made by means of a primitive, apparently frail, but really staunch craft called a zak. This consists of goat skins, usually twenty-four in number, inflated and attached by woollen cords to six or eight slender poles placed parallel to one another. It is buoyant, and breasts the billows of the most turbulent streams in safety. It is managed by a crew of four men, armed with willow or poplar poles about 8 feet long, with which they push it with considerable skill across the rapid currents. It is so light that its crew can easily carry it to any desired point, and the skins can be deflated, detached from the poles, and packed for transport in a short time.

As it has no floor except the skeleton of poles, the passenger must be careful where he treads, or he will find himself stepping through into the water. He stoops so as to keep the centre of gravity low, balancing his feet on two poles whilst he grasps two others with his hands. The water of the seething torrents washes over the craft when well laden, often wetting the feet of the passenger to the ankles; but this is an incident he does not mind so that he gets safely over the river. The embarkation is made at a point hundreds of feet above the landing-place on the other side to allow for the rapidity of the current, which carries the zak swiftly downward. As only five or six persons can be carried at one time, several hours are required to get a caravan over a river.

The village of Arandu lies at an altitude of 9500 feet, on an alluvial terrace directly in front of the converging snouts of the Tippur glacier on the south and the Chogo Lungma on the west. This terrace differs from the other fertile oases in the valleys below in that it has no fruit trees, producing only grain and a few vegetables. It belongs to the Tippur slope rather than to that of the Chogo Lungma. It may be an alluvial fan washed out at some distant period from the Tippur nullah; but it seems more likely to be the termination of the talus sloping down from the mountain, which forms the opening wall of that valley on the west. This talus is continuous with the Arandu terrace, and for several hundred feet above it is covered with grass and other vegetation.

Arandu is a small village, and can muster only about thirty coolies. Its headman or lambardar accompanied us on both our expeditions to the Chogo Lungma, in charge of the coolies and their food. His moral code was not modelled after the strictest Christian ideals; and on one

occasion, when sent down to Arandu in an emergency to bring up supplies, although he knew we urgently needed all he could get, he did not hesitate to dispose, at a good price, of a sheep and several dozen eggs and fowls charged to our account, to a sportsman whom he met, telling us they were lost in the snow.

Still, though we never felt we could depend on his loyalty, through a judicious mixture of coaxing and threatening and promises of a good bakhshish he was induced to remain fairly faithful to us, and proved really useful in keeping the coolies up to their work. In comparison with the nine other Basha valley lambardars, we came to regard him almost as a friend and a pattern of Balti morality. The last attitude in which we remember him was that of prostration before us at the door of our tent, salaaming and touching his forehead repeatedly with his right hand in acknowledgment of the reward received for his devotion to our cause.

The Tippur glacier, which has never been explored, comes down through a gorge between precipitous rock mountains high above Arandu, and extends its snout, broken into séracs to the end to within 1846 feet of the village. It has evidently been advancing for several if not many years, for it has built entirely around the part outside the gorge a high and massive terminal moraine, above which the ice towers from 50 to 100 feet, and against which it crowds, overhanging it in many places. At the extreme end and at one other point the ice has broken over its moraine barrier, and a line of séracs projects halfway down the side of the latter.

The top of the moraine at the nearest point to the village is 415 feet above it. The glacier is adding to the moraine at a rapid rate, discharging upon it constant showers of boulders, rocks, and sand with a thunder which resounds through the air day and night. In short, this glacier may be considered at present to be in an aggressive mood. Formerly it reached considerably farther down the valley than now, the old terminal moraine being covered with a thick growth of grass, shrubs, willows, and tamarisks.

On the contrary, the snout of the far larger Chogo Lungma comes down its valley without fuss or noise to within 1184 feet of Arandu, where, on a level with the latter shelving away to a thin edge, it dies out like a spent wave almost imperceptibly on the river-bed.

The Chogo Lungma glacier runs a winding course nearly north of west from Arandu for a distance of 30 miles to its source in a col nearly 20,000 feet above sea-level. In these 30 miles it rises from a height of 9500 feet at Arandu to 19,000 feet at the base of the col. Its width varies from about a mile at its lower end to about 2 miles at its upper middle portion. For convenience of description, it may be divided into three sections, according to the distinguishing characteristics of each.

The first or lowest section extends from the end of the snout 9 miles

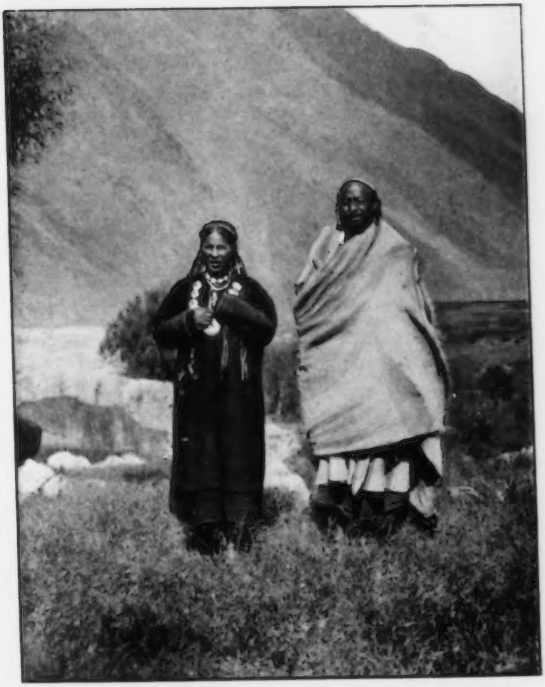

FIG. 3.—THE LAMBARDAR OF ARANDU AND HIS WIFE.

FIG. 4.—THE SNOUT OF THE CHOGO LUNGMA GLACIER, WITH RIVER-BED AND CULTIVATED FIELDS OF ARANDU IN FOREGROUND.

upward to a point above the first bend. The surface of this section is broken up into a confused mass of pointed hillocks, highest along the meridian line, sharp ridges, and deep ravines. It is so thickly covered with mud, sand, granite, conglomerate, and shaly detritus of every size, from small fragments to huge boulders and slabs, that ice is scarcely seen, and where it does appear it is black and smutty. Placed suddenly upon it, one could imagine one's self in a desert of torn and splintered rock rather than on a glacier.

What becomes of the immense mass of *débris* that covers this section to its very end it is difficult to conjecture. One might suppose that its accumulation would long ago have blocked the wide valley below with a wall hundreds of feet high, and buried the village of Arandu deep out of sight; but, little evidence of such accumulation is seen, and the fair fields of Arandu still lift their luxuriant burden of grain to the breezes, unharmed by the threatening monster above. There is no terminal moraine worth mention, only a few insignificant stone-heaps just beyond the end of the snout, left by the receding ice—a great contrast to the huge moraine enveloping the snout of the neighbouring Tipper glacier.

The snout itself projects from the glacier bed between the mountains like a gigantic stranded whale, its naked, sloping, glistening, black flank, at first some 200 feet high, tapering down to a small point. Some distance up on its side, near where it leaves the right lateral moraine, a good-sized river flows out from under it, which follows its edge nearly to its end, and then turns across the stone-strewn interval towards Arandu, beyond which it joins the stream coming down on the opposite side from the Kero Lungma to form the Bisha river.

This section of the glacier has dwindled greatly from its former volume. Colonel Godwin Austen says that in 1862 the ice was encroaching on the Arandu terrace. Now it nowhere touches it, and has receded to a point 1184 feet west of the village. The signs of recession below the end of the snout are so faint, that one could not judge from them that more than a slight diminution in its actual length has occurred in recent years, but immediately one ascends the glacier the evidence is more pronounced. A quarter of a mile above the end the side of the snout has receded more than 200 feet from the high right lateral moraine.

On account of the broken and crevassed surface of the lower section of the glacier and the steepness of the mountain walls on the right bank, the only way to ascend it is to cross over it from Arandu to the left bank, and for the next 14 miles to follow the detritus-strewn space between the former lateral moraines and the present ones. Here the recession is very marked. The ice now lies at distances of 50 to 600 feet from the original bank, consisting of the mountain flanks, which are banded by large primary moraines.

Between these and the moraines adjoining the ice is a system of

more or less parallel secondary moraines, separated from one another by considerable intervals. At one place I counted six parallel moraines of this kind. From these we may infer (1) that the shrinkage has been going on for a long time, as is shown by the fact that the primary and some of the secondary moraines are covered with vegetation and trees; (2) that there have been periods of arrest in this process when the glacier was stationary or slightly advancing, during which the secondary moraines were formed; (3) that the glacier is still retreating, as the ice slants sharply back, and in some places has melted entirely away from the moraines last formed.

Just below the upper end of this section a well-marked moraine rises on the shoulder of a mountain spur more than 100 feet above the level of the ice opposite. To build this moraine, the surface of the glacier must have been from 150 to 200 feet higher than at present. This represents an important diminution of the glacier in thickness as well as in width. At no point in this section was it advancing or crowding its left lateral moraines, but everywhere receding from them.

At one place in the lower part of the second section, for a distance of more than 1500 feet, the ice, which in 1902 had receded from the lateral moraine, in 1903 was pressing hard against and overlapping it, owing probably to the increased thrust of the large branches opposite sent down from the Haramosh range.

At some points the lateral moraines are high and massive, at others small. The height of one was measured at 115 feet on the shorter side next the mountain, and others must have been 150 feet or more. In several places moraines were being formed along the sides of huge ice-walls, the process being the same as the formation of tali at the base of mountain precipices. In this case the *débris* near the edge of the glacier is set free by the melting of the ice, and, falling down the sloping side, accumulates in a moraine at the base.

Here and there along the left bank of the first and second sections of the glacier, examples occur of the sand, grass, flower, or bush covered maidans often seen on the sides of Himalayan glaciers. These are level or gently inclined meadows lying between the mountain slopes and the lateral moraines.

They are found at places where the slopes recede from the glacial bed, at the entrance of side valleys, and at the confluence of glaciers, where the lateral pressure is not great enough to force the glaciers against the mountain walls. The moraine barriers usually run in a straight line, except at the junction of glaciers, where pressure may cause them to be formed on a curve.

The maidans are, as a rule, free from stones, and, if at the entrance of side valleys, may have small clear streams running through them, hence they afford convenient and safe places for camping purposes.

In those I have examined no moraine deposits have been found on

FIG. 5.—SECTION OF LATERAL ICE-WALL OF BLACK ICE, ABOUT 200 FEET HIGH AND 400 LONG. MORAINE FORMING AT ITS BASE.

FIG. 6.—HARAMOSH GLACIER AT ITS ENTRANCE INTO THE CHOGO LUNGMA. MOUNT HARAMOSH, 24,270 FEET, 11 MILES AWAY AT EXTREME LEFT. IN BACKGROUND BEAUTIFUL SNOW-NEEDLES OF INDUS-NAGAR WATERSHED, PEAK NO. 4, 22,810 FEET HIGH. IN FRONT OF IT ROCK SPUR ENDING IN ROCK PEAK NAMED CHOGO LUNGMA RIFFELHORN, 15,337 FEET, ON WHICH IS SEEN LAYER OF BLACK SLATE LYING OVER THE GREY GRANITE. BASE CAMP ON SNOW-FLECKED SLOPE AT END.

the mountain slopes at the foot of which they lie, and which themselves are often covered with grass and flowers continuous with those of the maidan. Nor has such deposit been found upon or in the rich alluvial surface of many of the maidans or the sandy surface of others. The first evidence of moraine deposition is seen in the sharply defined enclosing moraines, which overlie the maidan surface as extraneous structures.

These facts, together with the important one that the maidans may be covered with a luxuriant growth of grass, flowers, or bushes, while the enclosing moraines may be destitute of any vegetation, point to the conclusion that the maidans were formed like any other terraces at a time antecedent to the formation of the moraines, and that the latter were superimposed on their edges at a later period, probably curtailing their area to a considerable extent.

These maidans must not be confounded with the spaces strewn with rock *débris* lying between primary and secondary lateral moraines.

The second section extends upwards for 13 miles, to a mountain wall above the entrance of the Haramosh glacier, where the Chogo Lungma makes a short turn to the south-west. This may be called the section of medial moraines, of which there are six well-marked ones, some of the larger presenting several distinct ridges, which, if counted as separate moraines, would swell the number to between fifteen and twenty.

At the beginning of this section, white ice first appears in the shape of a vast white tongue extending downward from above along the middle of the glacier. This is flanked by dark medial moraine-bands bearing the detritus already mentioned. Opposite the peak Kupultung Kung, owing to some cause which is not apparent, the moraines, which in places rise from 60 to 150 feet above the white ice, sink to the general level and lose their identity, joining together to form the chaotic structure seen lower down, the white ice disappearing from view.

As the glacier is ascended, two bands of white ice appear, separated by a huge moraine, the second originating in the Haramosh glacier, the largest branch of the Chogo Lungma. Throughout the second section the edges of the glacier are much broken and crevassed, owing to the entrance of branch glaciers on both sides, the crevasses being comparatively short, and running in various directions according to the pressure. To find one's way from the bank through the labyrinth of resulting séracs to the white ice in the middle requires considerable mountaineering skill, but once gained, the latter, being fairly smooth and free from large crevasses, affords a safe passage to the end of the section.

The bend of the glacier to the south-west forms a good-sized basin, into which open five large feeders of the great stream below, bearing somewhat the relation to it that the spread fingers do to the palm of the hand. Four of these we explored to their sources.

Projecting well into this basin, adjacent to the Haramosh glacier on the west, is a rock promontory, the end of a ragged spur sent off from the splendid so-called Indus Nagar watershed, peak No. 4, the most beautiful snow-needle I have anywhere seen. From this promontory rise two rock summits, one of which so strongly resembles the Riffelhorn at Zermatt, as seen from the Gorner glacier, that we christened it the Chogo Lungma Riffelhorn. Although a pygmy in comparison with the peaks around it, it is a giant as compared with the Zermatt peak, having an altitude of 15,337 feet to the latter's 9617. This summit is peculiar in that a wide band of black slaty rock is superimposed from bottom to top, on the granite of which it mainly consists. We scaled this several times during both seasons, and built a cairn on its summit, in which records were left.

On this promontory we established our base camp during the seasons of 1902 and 1903, and, as both summers were stormy, we spent considerable time here. It afforded an excellent point from which to study the region and the medial moraines. Records were also deposited in a cairn built at this camp.

The large Haramosh glacier sweeps down nearly at a right angle upon the Chogo Lungma with a thrust so great that the latter is pushed over towards its left bank, and the Haramosh turns to the right in a wide curve and crowds itself in on the right of the main stream, forming thenceforth nearly half the width of the glacier, and preserving its identity to the middle of the second section.

The detritus borne along on the left edge of the Haramosh glacier forms, at the line of junction with the Chogo Lungma, a large moraine in the middle of the glacier, which is pushed high up above the surrounding level by the lateral pressure of the two streams. Where the glaciers first come together, the moraine is not very pronounced, but it becomes more so as they descend. The granite of which it is composed has a reddish colour from the iron it contains. About a mile below the junction of the two glaciers, another medial moraine of black *débris* springs up by the side of the former without traceable origin, and after a short distance increases in size and height, rising 150 feet or more from the general level until it quite overshadows the Haramosh moraine, though it nowhere reaches more than half the width of the latter.

It is cleft by enormous transverse crevasses. Below the Bolucho branch these two moraines coalesce and present a uniform dark colour, sinking nearly to the level of the white ice. The detritus on the right side of the Haramosh glacier with that from the tributaries below, forms a wide right medial moraine belt with several moraines, whilst that from the left side of the basin and left tributaries forms a left medial moraine much narrower than the belt on the right.

The greater part of the *débris* of the left moraine appears to be cast out on the side to form the giant lateral moraines there seen, but sufficient

FIG. 7.—VIEW DOWN THE CHOGO LUNGMA FROM HEIGHT OF 18,700 FEET, SHOWING THE WINDING MORAINES. AT RIGHT SNOW-PEAK OF 17,814 FEET ASCENDED IN AUGUST, 1902.

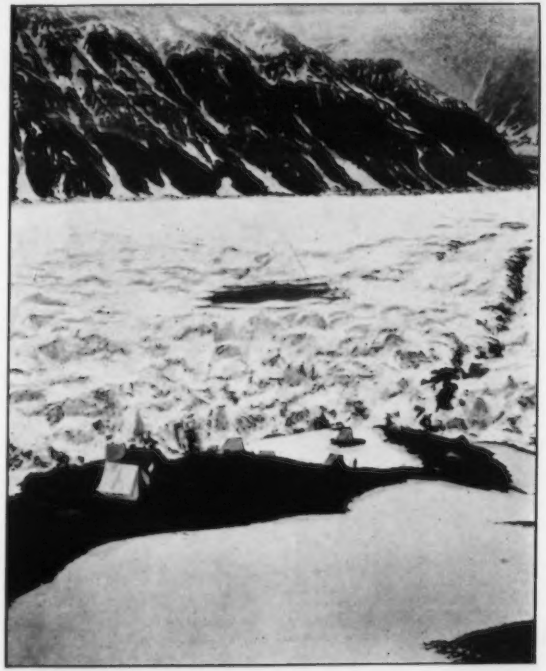

FIG. 8.—BASE CAMP ON RIFFELHORN SLOPE, TAKEN FROM ABOVE. GLACIER ABOUT 2 MILES WIDE. SÉRACS ON NEAR SIDE. ICE-LAKE ABOUT HALF A MILE FROM GLACIER EDGE BELOW CAMP. BLACK LINE AT EXTREME RIGHT SHOWS THE BEGINNING OF THE LARGE HARAMOSH MORAINE WHERE GLACIERS FIRST COME TOGETHER.

is left with that of the right central ones to conceal the ice of the lowest section entirely from view.

The medial moraines mark the course of the ice-currents caused by the entrance of tributary glaciers and the conformation of the bed of the main stream. These currents, which are complicated, would make an interesting study for one who had time to devote to mapping them. Above the Riffel promontory, one black moraine originating under a mountain on the right bank pushes diagonally across the glacier some 3 miles to join the left latero-medial moraine.

Opposite Riffel camp a large depression occurs in the glacier, the surface of which here is much cut up by crevasses. In the centre of this there is a good-sized lake with streams running into and out of it. This presented the same appearance in 1903 as in 1902, and will probably continue to exist until the movement of the glacier opens an outlet in its bed.

The Haramosh glacier runs south by west from the Chogo Lungma 11 miles to the base of the steep flanks of Mount Haramosh (24,270 feet), where it ends in a long snow-covered ice-field or pass seamed with wide crevasses, which dips down steeply on the other side to a valley leading to the Indus. The height of this pass is 17,412 feet. As its discoverers, we named it the Amar Singh La, after General Raja Sir Amar Singh, K.C.S.I., of Kashmir. The scenery here is of the wildest and most sublime description, whole mountain slopes presenting a chaos of glittering ice-falls.

The third section of the Chogo Lungma comprises the remaining 8 miles to the col. In this distance the glacier rises 5000 feet, from 14,000 to 19,000, and is walled in by impressive mountains from 21,000 to 24,500 feet high, whose ice-clad sides rise sharply from it. Here moraines and rock *débris* cease to be prominent, their place being taken by a broken surface of séracs and icefalls, and higher up by *névé* and driven snow.

The séracs begin at Riffel promontory and continue for about a mile, spreading halfway across the glacier. They are largest and most broken near the right bank. Two other series occur above, rising so steeply as to constitute ice-falls. Wide crevasses of unmeasured depth exist over the whole of this portion, in some places in great numbers, in others more scattered. These crevasses do not run transversely from bank to bank as at one place on the Biafo glacier, but take every direction, often ending in huge ice-caverns. This indicates irregularity of the glacial bed. The general effect of the second ice-fall, about 3 miles above Riffel promontory, is, however, that of transverse terraces rising above one another.

This section is not easy to ascend. In addition to the steepness of the gradient and the effect of altitude on the system, one has to thread one's way through the pathless labyrinth of séracs, neither

a very easy nor safe operation, to contend with soft snow which increases in quantity as one ascends, till near the col it reaches a depth of over 3 feet, endure the burning heat of the sun in clear weather, and cold winds and cutting sleet in foul; camp on the glacier in soft snow, with a temperature falling perhaps to zero, and, worst of all, contend with the unwillingness of coolies to proceed, without whose aid nothing can be accomplished, running the almost certain risk of being forced back by them or of being deserted and left helpless in the snow in case the weather becomes threatening.

This is the formative basin of the glacier, an elevated savage wilderness of snow, ice, and rock. Here the snow collects with every storm throughout the year till it lies many feet deep on the solid ice beneath, to which it freezes, and whose volume it helps to swell. Large hanging glaciers pour down their ice contingent in tumultuous confusion to add to the masses below, while the precipitous mountain flanks hurl down snow and ice avalanches of enormous size with a force which causes the earth to tremble, and a thunder which is heard for miles. Avalanches here are constantly falling, and constitute an element of danger which has to be reckoned with in every move that is made.

Near the head of the glacier we narrowly escaped the largest avalanche it has ever been my fortune to see. The width of the glacier at this point is about a mile, the surface strongly undulating, and the mountain slopes on both sides extremely steep. As we passed along the middle of the glacier in front of one threatening wall we tried to hurry the coolies, whose movements, as usual, were of the most leisurely character. They gave little heed to our admonition, and would not quicken their pace.

The last coolie had passed the wall by only ten minutes, when we were startled by an ominous roar behind. Looking around, we saw what seemed to be the whole mountain-side in motion. The huge curling cornice that had graced its brow and excited our fears had broken loose. Vast masses of snow and solid ice were sliding downward, rolling over one another, leaping through the air, and smashing themselves against the rocks with hissing, growlings, and crashings, as if all the demons of the infernal regions were expending their wrath on that mountain wall. Thick clouds of snow-dust were thrown hundreds of feet in the air.

As the mass struck the glacier it seemed to hesitate a moment, then, gathering head, with a high swelling front at least half a mile wide, it shot across the glacier regardless of undulations and gradients, leaving in its train a chaos that must be seen to be appreciated, till it finally expended its force well over towards the farther side of the glacier. The cloud of snow-dust raised by it rolled majestically onward till it was dissipated on the heights opposite. The forces of nature

among these great mountains, when dormant, pass unobserved, but when aroused to action, be they those of air, water, rock, or snow, the effects are indescribably sublime and awe-inspiring.

Five miles from the col the last and highest tributary of the Chogo Lungma enters it from the south with a great, much-broken ice-fall, the confluence of the two forming a large slanting basin, the middle of which lies at an altitude of about 16,000 feet. This glacier is about a mile wide and 6 miles long. It is deeply covered with snow, as are the mountains around it, which discharge from both sides upon it avalanches that sweep its whole width. It is seamed with crevasses, some of which extend from one bank to the other. It ends in a snow-col above 19,000 feet in height, beyond which valleys descend towards the Indus and Gilgit.

From the entrance of this tributary to the base of the terminal col, 5 miles distant, the Chogo Lungma consists of a series of vast rounded ice-hillocks slanting sharply up to the mountains at the sides and rising steeply above one another, their surfaces broken by yawning ice-caverns, and deeply covered with snow. The ascent here is very fatiguing, resembling that of a stiff snow-mountain. The col itself crowns a massive ice-wall rising sharply from the glacier to an estimated height of 800 feet above it. The col is nearly 20,000 feet above sea-level. The continuity of the wall is broken by ice-falls and bergschrunds, and its whole surface is covered with a thick mantle of soft snow. We named this the Pratap Singh Col, in honour of His Highness the Maharaja of Kashmir and Jammu.

In August, 1902, after much trouble with our coolies, who were disheartened by the steep gradient and depth of the snow, we succeeded in reaching the base of this wall, and camped at a height of 18,995 feet with the intention of climbing it. In the afternoon we cut steps up the lower half, intending to make the ascent the next morning. At daylight clouds and mist began to roll over the col, and by seven o'clock it was entirely obscured from view. The barometer fell rapidly, and, as a storm was evidently on, we struck tents and beat a retreat to a camp at 15,096 feet, six hours below, on a mountain-side.

By ten o'clock snow was falling thick and fast. At one we pitched our tents in 4 inches of snow on the stone terraces we had previously built out from the rather steep slant for this purpose. That storm lasted sixty hours without interruption, during which time it kept us occupied in clearing away the snow from and about the tents to prevent their collapse. The next morning the fifty-five coolies who were with us deserted in a body, returning to the base camp, and left us alone with the camp-servants to weather the storm. After the storm had ceased forty of them returned, having been sent back by the lambardar.

A few days later the porters and two coolies went up to bring down the Mummery tents we had left behind with the intention of returning.

These were found buried under 5 feet of new snow. The depth of the snow, the lateness of the season, and the danger from avalanches prevented our returning to the col that season. During the stormy summer of 1903, there was so much snow on the glacier above 17,000 feet that we did not attempt to revisit it, knowing it would be impossible for loaded coolies to reach its base.

In 1902, when we made the terraces for the camp here seen, the mountain-side for 1000 feet above was free from snow. In July, 1903, the camp site was covered with avalanche *débris*. Our tent terraces and a strong stone cairn we built just above had been swept away by avalanches, resulting from the unusual accumulation of snow during the winter.

The upper section of the Chogo Lungma is bounded on the north by a massive mountain wall covered with ice, leading up to three splendid snow summits, the highest of which, over 24,500 feet, dominates the whole region. Taking advantage of a series of fine days in August, 1903, we pushed our camp to a height of 19,358 feet on the much-broken snow-flank of the first peak. On August 12, after scaling the first two peaks having altitudes of 21,500 and 22,567 feet respectively, the two guides, Petigax, Savoie, and myself succeeded in reaching a point on the south-west arête of the third, 23,394 feet in altitude, from which we had a wonderful view, three-quarters of a circle in extent, upon a billowy mass of glaciers, valleys, mountain ranges, and peaks of every shape and height. The Pratap Singh col beneath our feet, at the head of the Chogo Lungma, was seen to be the beginning of a snow pass, named by us the Pratap Singh La, that runs for some distance between high snow-peaks, and then suddenly drops down to a glacier that slopes gently away to a rock valley leading apparently toward Nagar. This route to Nagar would not be available to travellers on account of its mountaineering difficulties, and no coolies could be induced to pass the Pratap Singh La.

To do justice to the remaining branches of the Chogo Lungma would require an evening. They have their origin in high, wild, riven, and snow-covered rock basins, fall sharply, are split up by deep crevasses into ice-falls and séracs, and bring down immense quantities of mountain *débris* to the main glacier. Some of them are beautifully marked by moraines.

The southern branches, coming from higher and more snowy mountains, are larger than those on the north side, and are, apparently, not receding. Several of the northern branches have receded greatly, and some of the smaller ones have entirely disappeared. One of the large tributaries, the Bolucho, has ceased to have any connection with the Chogo Lungma, having retreated some distance up its valley, leaving its bed covered with a chaos of granite *débris*. Two large moraines on the mountain-sides at the valley opening show that the ice must formerly

FIG. 9.—SECTION OF THE ICE-LAKE, WITH ICE-WALL ON FURTHER SIDE.

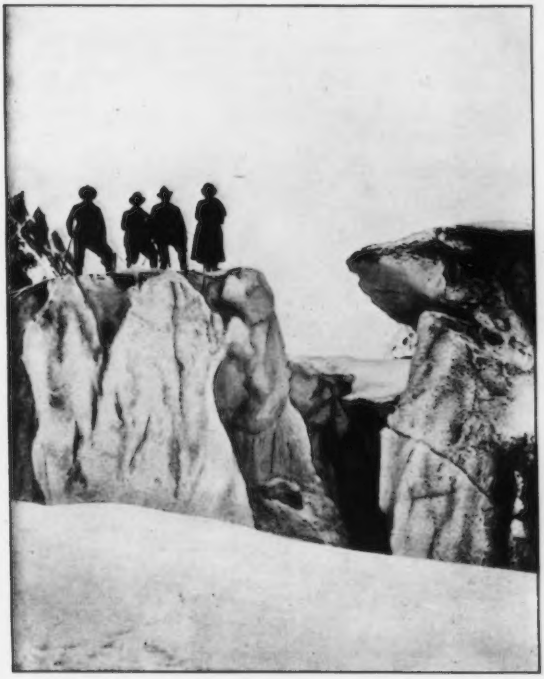

FIG. 10.—ON THE EDGE OF A CREVASSE AT TOP OF ICE-FALL.

have been at least 250 feet thick at its junction with the Chogo Lungma.

It might be supposed that, at altitudes of 16,000 to 20,000 feet, in a region covered with ice and snow, where the temperature in the shade rarely exceeds 55° Fahr. at noon, and at night always falls as low as 20° Fahr., and sometimes to the neighbourhood of zero, one would not suffer from heat. The reverse is, however, the case. On clear and partially cloudy days, as soon as the sun appears above the mountains, the heat of its rays becomes quite sensible, and after nine o'clock one feels as if one were in a fiery furnace. The more snow there is—at these altitudes everything except perpendicular rock faces is usually covered with snow—and the fresher and whiter it is, the greater the heat. The reflected heat is as hard, if not harder, to bear than the direct heat of the sun, and shielding one's self from the direct rays of the latter affords no relief so long as one is exposed to the reflection from the snow. By noon, with new snow, the heat becomes intolerable, and together with the altitude causes headache and lassitude.

The effects of the reflected heat on the skin of Europeans are more severe than I have ever seen at sea-level or at low altitudes. The hands and face are soon burned to a deep copper red. The skin of the face becomes swelled, vesicated, and even blistered. The lips likewise swell, and become covered with exceedingly painful herpetic eruptions, which require a month to heal. In fact, one becomes so disfigured that one's best friends would not recognize one. The submaxillary glands enlarge and become tender in sympathy with the facial inflammation. The pain, especially from the lesions of the lips, is referred to the dental nerves, and the explorer often comes to doubt the integrity of teeth with which he has never before had occasion to quarrel. We tried to protect our faces by wearing white muslin masks, but, in spite of apertures for nose and mouth, we found they interfered with respiration to such a degree that they were cast aside as useless. Moreover, they were uncomfortable, the reflected heat burning strongly through them. In any case, to be really effective, the white muslin should have a lining of black or red, which combination has been found in the tropics to afford the best protection against the sun's heat.

As a comparison with the effect of heat on the skin in the Indian plain, I may state that in the course of our extensive cycle journey of 14,000 miles in India, Mrs. Fanny Bullock Workman and myself were exposed day after day for weeks together from morning till night to the full blaze of the Indian sun, in shade temperatures reaching above 100° Fahr., with no protection to our faces except a sola topi, and our faces were never burned so as to be in any degree painful.

The lighter the complexion the more one suffers from the reflected heat. The darker-skinned coolies and servants with us were not affected at all, whilst some with blue eyes, brown hair, and moderately

dark skin showed slight reddening of nose and cheeks, but nothing more. The Europeans of the party shed the cuticle of their faces every three or four days. This suggests that the application of burnt cork to the face might prove an efficient protection. We tried this for one day, after our faces had been painfully burned, and thought the skin felt cooler for it; but the disadvantages of this preventive, in the absence of water to wash it off with, were such that we did not repeat it.

The actual temperature of the sun's rays may be judged from the following figures. The maximum temperature taken with the black-bulb solar thermometer on the only ten available clear days between July 18 and August 17, 1903, at altitudes from 14,067 to 18,811 feet, ranged from 183° to 204° Fahr., the corresponding shade temperatures ranging from 47° to 60° Fahr. The average of these ten observations gives 190·75° Fahr. in the sun and 56·4° Fahr. in the shade.

Compare these with the highest sun and shade temperatures recorded during the summer of 1903 at two stations not much above sea-level in the plains. The figures were kindly given me by Sir John Eliot, M.A., F.R.S., K.C.S.I., Meteorological Reporter to the Government of India and Director-General of Indian Observatories. At Alipore, near Calcutta, the highest sun temperature was 161·9° Fahr. on May 22, the shade temperature being 106·2° Fahr. At Lahore the highest sun temperature was 172·6 Fahr. on May 31, the shade being 113° Fahr. The highest recorded sun temperature at these two representative stations in the plains was therefore 10·4° lower than the lowest maximum above 14,000 feet, and 31·6° lower than the highest.

The obvious deduction from these figures, and also from the physiological effects stated above, borne out by other observations, which want of time forbids me to cite here, is, that the higher the altitude and the thinner the air, the greater the energy with which the sun's rays strike the earth. The sudden change from great heat by day to severe frost at night is undoubtedly an important factor in the rapid disintegration which is taking place in the exposed rocks of these high Asiatic mountains. Nearly all the surface rocks of the mountains I have climbed in Baltistan have been found rotten and crumbling, the constituents of the sandstones and quartzites in particular having often so lost their cohesion that they could be rubbed to sand between the fingers.

The temperature of 204° Fahr. was registered at an altitude of 17,322 feet, the shade temperature being 56° Fahr. I do not consider this temperature abnormally high. The same figure was recorded at about the same altitude in 1902. It will be noticed that our maxima were obtained the latter half of July and the first half of August, at a time when the sun's rays had passed their greatest power, and that the much lower maxima at Alipore and Lahore were actually the highest records of the whole summer. On June 14, 1903, the sun

temperature at Shigar, at an altitude of about 8500 feet, was 206° Fahr. I have no doubt that, had the weather been more favourable, so that observations could have been taken at high altitudes in June and early in July, still higher readings would have been obtained. The thermometer used was compared and found to correspond with the most reliable one at the Government station at Lahore.

The tree-growth in the Chogo Lungma valley is scanty, consisting chiefly of willows and cedars, and these are found only on the north or left side. Willows cease at a height of about 11,600 feet, while cedars are scattered over the mountain slopes to about 12,800 feet. We found, cut up, and used for fuel many cedar trunks which had lain prostrate for an unknown period, larger than those of most of the trees now growing. The coolies, when not otherwise employed, were kept busy in transporting the fuel so obtained to our base camp above tree-growth.

Besides trees there is a species of bush, the name of which I do not know, which is found to a height of 14,400 feet, though stunted above 13,000 feet. This at its best attains a height of 10 to 12 feet. Its wood is hard, and it makes a much better fuel than the willows and cedars. Grass and some Alpine flora are found to about 15,000 feet in favoured spots. Above this is the domain of rock and ice.

Let us assume the snow-line to be at the altitude where the ordinary winter accumulation of snow remains on the ground at all seasons of the year. The determination of this line is difficult in a region like that around the Chogo Lungma, split up into irregular, ragged, towering peaks and deep, tortuous valleys. Many of the mountains far above the snow-line have such sharp slants and perpendicular faces that snow will not lodge on them, and these remain bare of snow at all times, while snow accumulates in their ravines at comparatively low altitudes to such an extent, that the heat of half a dozen summers would not melt it.

Snow-beds of this character are not unfrequently seen lying exposed to the sun throughout the summer as low as 12,000 feet. Glaciers, deep snow-beds, and perpendicular rock faces have to be eliminated from the problem, and the solution sought on even regular slopes, where the depth of snow represents the average snowfall. Such slopes near the snow-line are not easily found on the Chogo Lungma. But even with such the snow-line varies with the exposure, being higher on southern than on northern slopes, and it also varies with the season, being considerably lower after severe winters with great snowfall and in cold stormy summers, when snow covers the hills during every storm to points far below the actual snow-line. The snow-line is usually highest in this region about the end of August.

In August, 1902, in ascending the south side of a mountain 17,814 feet high, with a broad snow-capped top, we first encountered snow at 17,400 feet. The north side of this mountain was covered with snow

as low as 16,000 feet. On another peak not far from the Chogo Lungma of 17,600 feet, we found in July no snow except in small patches till the top was reached, and then only on the north slope, where it extended downward in a large snow-field. In July, 1903, both these peaks were snow-covered on their south sides for a long distance below their summits. The snow-line must therefore be considered indeterminate, and may be said to vary from 16,000 to nearly 18,000 feet according to season and exposure.

Measurements were made by Mr. Hewett at two stations to determine the movement of the glacier. The first station was on the north bank 15 miles above the termination of the glacier. The movement in twenty-four hours—

At a point	1583	feet from the station	was found	to be	1·59 feet.
„	1902	„	„	„	3·16 „
„	2828	„	„	„	2·40 „
„	4084	„	„	„	3·29 „
„	5021	„	„	„	2·45 „
„	5094	„	„	„	3·08 „

The second station was on the south bank 3 miles higher, just below the entrance of the Haramosh glacier. The movement here in twenty-four hours—

At a point	1302	feet from the station	was found	to be	1·40 feet.
„	1502	„	„	„	1·83 „
„	3140	„	„	„	2·42 „
„	3305	„	„	„	2·69 „

These observations are not carried sufficiently far to permit of any extended deductions being made from them. They appear to show that at certain points on two lines running transversely across the glacier, the ice was moving at different rates, varying from 580 to 1200 feet per annum, which indicated the existence of different ice-currents moving at different speeds. How far the speed observed for a given point would be preserved is uncertain. Could the same points be identified farther up or down the glacier, probably their rates of movement, both actual and relative, would be found quite different from those observed.

The first set of figures are so irregular among themselves, that no conclusion as to the movement of the glacier as a whole can be drawn from them. It is possible that the lateral pressure of the Haramosh glacier, which even here must be considerable, together with that from other branches, might cause the ice-currents of the left half of the glacier to move among themselves with the velocities indicated; but this is mere supposition.

On the contrary, the points on the second or upper line have an increasing rate of movement from the station towards the centre of the glacier, showing that they were moving on the radius of a curve,

FIG. 11.—SNOW-CAPPED SÉRAC OF BLACK ICE NEAR EDGE OF GLACIER. STEEP MOUNTAIN-SIDE IN BACKGROUND, ON WHICH PATH MAY BE SEEN. ON ONE EXPEDITION WE GOT UPON THE GLACIER BY THREADING THE SÉRAC LABYRINTH JUST ABOVE THIS, BUT, ON OUR RETURN FOUR DAYS LATER, FOUND OUR BRIDGES WRECKED BY MOVEMENTS OF GLACIER, AND HAD TO FIND A NEW PATH, THROUGH SÉRACS LIKE THOSE HERE SEEN BELOW IT.

FIG. 12.—ON PEAK OF 17,814 FEET ASCENDED IN 1902. RISING FROM THE SAME RIDGE MASSIF AT DISTANCE OF SEVERAL MILES ARE TWO PEAKS OF 21,500 FEET, NAMED MOUNT CHOGO, 22,568 FEET, NAMED MOUNT LUNGMA, ASCENDED IN AUGUST, 1903, AND A PEAK OF OVER 24,500 FEET, ASCENDED TO A HEIGHT OF 23,394 FEET.

which represents just what was happening, the station being situated where the Haramosh glacier sweeps around in a great curve to force itself in on the right of the Chogo Lungma.

The opinion has often been expressed of late years that mountain sickness may be largely or wholly avoided by a gradual approach to high altitudes, so as to permit the system to become accustomed to diminished pressure and oxygen. Without discussing this opinion at length, I would cite a few facts bearing on it, which came under my notice during our expeditions in this region.

I have climbed in the Himalayas with eight other Europeans—nine in all. Of these, seven have reached altitudes of 21,000 feet, five an altitude of over 22,500 feet, and three that of practically 23,400 feet. No one of the nine, so far as I know, ever suffered from mountain sickness. We have ascended comparatively rapidly, usually reaching heights of 17,000 to 18,000 feet within a month after leaving sea-level. Much of our work above that height has been done within six weeks, and our highest at two months and a half.

In crossing the Skoro La in 1899, we took with us thirty-five coolies, who had lived all their lives at an altitude of about 8500 feet, and most of whom had crossed the 17,000-feet Skoro La to Askole more than once. The first day they made a light march of only three hours. The second day, at an altitude of about 15,500 feet, half of them were so prostrated by mountain sickness that we were obliged to encamp on a steep and exposed mountain-side.

In 1902, while ascending the Chogo Lungma, my instrument coolie, who had always lived in Arandu, 9500 feet, became very ill at 12,500 feet, and continued so for two days, after which he recovered and went with us to 19,000 feet without further trouble. The following year, after staying idle at our base camp at 14,000 feet for two weeks, he became severely ill again at 15,500 feet.

In 1903, out of twenty-two coolies from villages at altitudes of 9000 to 9500 feet, who were in excellent condition, having lived a life of ease for a month at our 14,000-foot base camp, during which time they had all put on flesh from the consumption of double the rations they would have used had they been obliged to furnish their own provisions, eight became so ill at 19,600 feet, that they lay like logs on the snow, oblivious to all attempts short of actual violence to induce them to move.

Whatever may be the effect of a prolonged sojourn at high altitudes as a modifier or preventive of mountain sickness, it is certain that a large proportion of our coolies, who had a lifelong advantage over us of 8500 to 9500 feet, besides that of being on their native ground, suffered severely from this affection, while the nine Europeans escaped entirely.

It seems to be the case with mountain sickness as with sea sickness, the symptoms of which two maladies are practically identical, though

the causes differ, (1) that some persons are immune to it at any altitudes that have been reached and under all circumstances; (2) that others are affected at given altitudes on some occasions and not on others, according to the amount of fatigue undergone and the condition of their bodily health; (3) that still others always suffer at certain elevations, just as some persons always become sea-sick on moderately rough water. How far the last two classes may be benefited by a prolonged sojourn at high altitude can only be determined by further experience.

The weather in this region, from the middle of June to the last week in August, is extremely uncertain. The monsoon makes its influence felt with prevailing winds from the south and west and a large number of stormy days. During the summer of 1902, there were rarely more than two clear days in succession, and only on one occasion did the number amount to four.

In 1903, with one interval of three fine days early in July, and five from August 8 to 12, there were only a few days when it was not stormy or the sky covered with heavy clouds. Much good work can be done on glaciers up to 17,000 feet in spite of unfavourable weather conditions; but it is not safe to attempt high-mountain climbing, where snow-camps must be made and several successive clear days are an absolute necessity.

In both seasons the weather became fine the last week in August, and continued so till September 12. So far as the weather is concerned, this seems to be the best time for high-snow exploration, but the disadvantage of short days and long nights, with increased cold, has to be incurred.

Exploring in these high regions is extremely fascinating, involving conditions not met with lower down. Were the available transport means, now so uncertain and unsatisfactory, at all adequate to the work in hand, many interesting questions connected with nature at high altitudes might be thoroughly investigated, which, as matters now stand, can only occasionally be touched upon.

In closing, I show a telephotograph of one of the most beautiful and striking of the Chogo Lungma peaks. We parted with the glacier and its mountains with regret after two seasons of most interesting association, during which we had studied them in their different moods, feeling that bonds of friendship with them were being severed which had been cemented by the vicissitudes of sunshine and storm.

NOTE.—In the autumn of 1903, after reports of our Baltistan expedition reached Europe, Major Max Schlagintweit published a statement in the *Mitteilungen*, that his brother, Adolf Schlagintweit, was the first to explore the Chogo Lungma region in 1856, and referred to vol. i. of the travels of the brothers Schlagintweit in support of this contention.

A careful examination of the books by the brothers Schlagintweit in the Library of the Royal Geographical Society in London and in the Royal Library

in Munich, as well as in that of the D. O. A. V. in Munich, including the work mentioned, fails to discover any mention whatever of the Chogo Lungma glacier or even of Arandu at its termination. Further, neither the Chogo Lungma nor Arandu is indicated on the elaborate maps which accompany the large work of the brothers Schlagintweit. Had Adolf Schlagintweit visited even the termination of so important a glacier as the Chogo Lungma, he certainly would not have failed to mention it in his writings and show it on his maps.

Before the reading of the paper, the PRESIDENT said: I have now great pleasure in introducing to the meeting our friend Dr. Hunter Workman, who will give us an interesting account of the exploration of some of the Himalayan glaciers.

After the reading of the paper, the PRESIDENT said: There are many things in Dr. Workman's interesting paper which might lead to discussion, and we have present with us this evening a most distinguished member of the old Indian Survey, whom I regret to say now seldom favours us with his presence, Colonel Godwin Austen, who is, I believe, the only surviving member of what I consider to be one of the most brilliant and accurate geographical pieces of work that ever was performed, namely, the Kashmir Survey. I hope Colonel Godwin Austen will now address us on the subject of Dr. Workman's paper.

Lieut.-Colonel GODWIN AUSTEN: It is almost superfluous for me to say how very much I have enjoyed looking at the beautiful series of photographs which Dr. Hunter Workman has shown us this evening. I have no doubt you have enjoyed looking at these photographs of Alpine scenery, to me it has even been a greater pleasure, because in the years 1860 and 1861 I was surveying these magnificent mountains. No one can imagine the magnificence of that scenery. I have had the privilege of reading Dr. Workman's paper. Early in his discourse he mentions the Indus valley and the wonderful effects of water-action and erosion on the hills on either side. That is perfectly true. The portion of the Indus valley, from the junction of the Dras river down to Skardo, is a wonderful gorge. You see there the action of former glaciation and beds of gravel and sand at an enormous height above the present level of the rivers; in fact, the glacial scenery you have been looking at this evening is only the remnant of the great glaciers that once filled those valleys. One of the pictures that you saw on the screen was the rock of Skardo that stands up in the middle of the valley. My work took me to visit the trigonometrical station at the top of that rock. There is an enormous transported block which has been left lying on the summit of that hill, and you have only to look round the sides of the valley of Skardo to see the enormous accumulation of gravel and sand that once filled the valley. The fact is that the history of the Indus valley has never been written. It goes back long into Tertiary times, and it has not only been excavated, but it has been filled up high with detritus, which has all been swept clean out of it again, and you only see now the remains of forces that were once in action. Perhaps one of the most interesting points is the end of the Arandu glacier. It is evident, from the photographs shown us this evening, and from Dr. Workman's description of it, that it has very much changed in the forty years since I was there. I have brought up with me a water-colour sketch of the end of the glacier, which I made in the year 1861. It shows quite a different outline from what it is at present. Again, the north bank of the glacier all the way up shows it has receded very much from the side of the mountain from what it was in 1861. At that time it abutted against the mountain-sides the whole way down, cutting off the drainage of the side valleys and formed a series of small lakes, all of which have disappeared since that time. The Arandu glacier, which we have heard about this evening, was first visited by Mr. G. T. Vigne in the

year 1835. He was the first Englishman who ever went into Baltistan, and he was the first to give an account of the large size and form seen from Arundo, but he never went up the glacier. He was followed by one or two others—I think Dr. Thompson was one—but they never went up the glacier any distance. The main trunk is pretty well known. I followed it up for about 22 to 25 miles, not in direct line. Frederick Drew, about three years after I was there, got, perhaps, a little further than I did, because he crossed to the centre. I did not go across the glacier, but made the attempt where the principal tributaries join; however, the glacier was terribly fissured, and I made such slow progress that I saw there was no hope of doing anything. I had a great deal of survey work to finish elsewhere, and I came back. It has remained for Dr. and Mrs. Workman's party to explore the recesses of this great glacier. It was very brave for Mrs. Bullock Workman to face all the discomforts of heat and cold and snow and exposure which work of that sort entails, and I am only glad to find there are travellers who will spend their time so admirably and so beneficially for us who live at home, and for all who are interested in great physical features — who spend their time on work of that sort, and come back with such beautiful photographs as we have seen to-night. I might say a great deal more about what you have seen this evening, but there is one thing I should like to mention. I think the word "la," at the end of the name of the Rajah of Kashmir (Pratap Singh La) is not correct, and also in the case of the Amar Singh La, because the term "la," which is in general use throughout the whole of Tibet, from Baltistan to Llasa and Bhutan, means a pass that is used for traffic, the highest portion of a road over a water-parting, and therefore I think it better to call depressions which are not used for traffic "colls," which is a more correct term than the word "la." I will not say anything further, except to again express my pleasure at seeing the photographs which we have had put before us this evening.

Colonel WAHAB: Personally I feel that we Indian surveyors, whose work takes us to the higher Himalayas, ought to be able to do more than we have hitherto done to extend our knowledge of glacial phenomena in those regions. Since the days of the Kashmir survey, however, when triangulation was being extended over the north-western Himalaya, very few officers have had the necessary opportunities—for although surveys have been pushed up to the snows on the Sikkim, Kumaon, and Punjab borders in recent years, nothing beyond reconnaissance work on small scales has been attempted in the remoter regions; the occasional political missions, also, which have crossed the high ranges, have not given time for any adequate mapping on scales large enough to illustrate the glaciation of the country.

Detailed surveys of the higher Himalaya have, in fact, never been regarded as within the scope of the Indian survey, nor, while so much work of importance elsewhere remains undone, is it to be expected that they should. For this reason, while we as Indian surveyors regret that we cannot ourselves take up work of such interest, we welcome travellers like Dr. and Mrs. Bullock Workman, who are prepared to place their experience and resources at the disposal of science, and to undertake what a utilitarian Government naturally does not feel justified in attempting. What is required to illustrate glacial phenomena is an accurate examination of a definite area, such as that of the Chogo Lungma and its tributary glaciers, so graphically described in Dr. Workman's lecture, and a careful re-examination of the area after a few years, so as to determine from actual observation the movement and variation of the glacier. Refined measurements, such as those periodically made on the Rhône glacier, would probably be impracticable at such a distance from civilization; but in a region where glacial phenomena are on so vast a scale as in the Himalaya, rougher methods would no doubt give valuable results.

It is to be hoped that the interest aroused in Himalayan exploration by the journeys of Mr. Douglas Freshfield and Dr. and Mrs. Workman will induce others to follow in their footsteps, and thus add a higher and more scientific value to their journeys and those of their predecessors.

The PRESIDENT: Mr. Freshfield is unable to attend here, but he has written a letter containing some interesting remarks which I am afraid there is hardly time to read at this late hour of the evening, but which will be printed with the paper. So it now only remains for us to pass a very cordial vote of thanks to Dr. Workman for his most interesting paper, and for the entertaining and beautiful views which he has been so kind as to put on the screen for us.

Mr. DOUGLAS W. FRESHFIELD sends the following :—

I very much regret I have been prevented to-night from listening to Dr. Hunter Workman's paper. I have studied it with great interest and sincere admiration, not only of the pluck and perseverance of Dr. Workman as a mountaineer, but also of the powers of scientific observation and graphic description shown by him as an author.

There are several points I should like to have commented on, which I will briefly mention here—

(1) With regard to water-erosion and the pot-holes found high on the mountain sides. Is it possible that these were formed when the slopes were more extensively buried in glaciers by subglacial torrents? These, as we all know, are peculiarly active in the formation of pot-holes, a pot-hole being almost the necessary complement of the *moulin* (or shaft), through which the torrent falls from the surface to the bed of the glacier.

(2) The fact that of two glaciers of which the lower ends are closely adjacent, one should be advancing and the other in retreat, is, as I pointed out at Cambridge, not so surprising as it may appear at first sight. The interval between the date when an increase of material is poured into the reservoir of a glacier and that of the corresponding advance of its snout is regulated by a variety of conditions, of which the chief are the length of the ice-stream, its bulk, and the angle of its bed. To put it in the simplest form of words, short and steep glaciers answer to an increase in their food supply more quickly than long and comparatively level glaciers.

(3) The absence or rarity of great terminal moraines may, I think, best be accounted for by the action of floods in carrying away all but the heaviest blocks.

(4) In general features, the glacier described corresponds to those under Kangchenjunga; in both cases the lowest portion is, as described by Dr. Workman, a desert of torn and splintered rocks. The first surveyors imagined the lowest 5 miles of the Zemu glacier to be moraine, and called it so on their map.

With regard to one of the chief obstacles to Himalayan exploration, the effects of high altitudes on the human frame, I welcome in Dr. Workman's narrative the confirmation by a medical expert of my own experiences. Immunity from mountain sickness, I agree, is not to be obtained by training—by living above 10,000 feet for a period. I have rather found the reverse to be the case; mountain-sickness is very much like sea-sickness: good sailors and mountaineers are more often born than made; that is, the immunity is mainly constitutional.

Again, the discomforts all, or almost all, climbers suffer from are not progressive from 12,000 feet upwards. On the contrary, in many instances they diminish above 15,000 feet.

A few years ago it was argued by very competent Alpine climbers that it was *a priori* impossible for men to climb, at any rate do more than crawl, at 22,000 to 24,000 feet. That argument can no longer be maintained.

Avalanches are a danger which it is, I hold, the duty of every climber who has been in these regions to insist on. They are on a scale wholly different from those of the Alps, and Alpine experience is at first likely to be misleading. Mr. Mummery's fate supplies the most emphatic warning on this point.

A minor but very serious trouble is the inflammation of the lips, mentioned by Dr. Workman. It becomes torture to eat, and men cannot climb without eating. Perhaps Dr. Workman may be able to suggest a palliative. I found boracic ointment useful.

The greatest difficulties in the way of climbers in the Himalaya are weather and transport.

As to weather, I can only suggest that some year luck may reward patience, and a climbing party get the ten consecutive fine midsummer days needed for an assault on a great peak. They must wait on the spot to profit by them.

As to transport, I see little hope until the Indian Government co-operates with an attempt to climb K^2 or Kangchenjunga, as the Home Government has co-operated with Arctic expeditions; until it puts fifty militarily trained and disciplined mountaineers at an explorer's disposal. Without this help a money grant would be little use; with it a relatively small sum, £1000 or £2000, might accomplish that desirable end—the conquest of the highest mountain in the world. We have heard lately a great deal of the moral qualities called out by polar exploration. I venture to think they are also called out to a great extent in mountaineering at high altitudes. There is surely some reason in the rhyme of the poet—it is true he was a mad poet—Blake—

> "Great things are done when men and mountains meet;
> These are not done by jostling in the street."

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND.*

Under the Direction of Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., etc., and LAURENCE PULLAR, F.R.S.E.

Part VII.—Lochs of the Shiel District.

In this paper it is proposed to deal with the results of the work of the Lake Survey among the lochs lying near the borders of Argyllshire and Inverness-shire, viz. (1) Lochs Shiel and Dilate, which drain by the river Shiel into Loch Moidart; (2) Loch Eilt, which flows by the river Ailort into Loch Ailort; and (3) Lochs Màma, na Creige Duibhe, and Dubh, which drain into Loch nan Uamh. The relative positions of these lochs are shown in the index map (Fig. 1). The principal loch is Loch Shiel, lying on the boundary-line between Argyll and Inverness, while Loch Dilate lies in Argyllshire, and the other lochs mentioned are situated in Inverness-shire. Mr. Garrett drew up some notes on Lochs Eilt, Dubh, Màma, and na Creige Duibhe before leaving for Borneo, and these have been embodied in this article.

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* Plates, p. 352.

1. Lochs of the Shiel Basin.

There are only two lochs belonging to this basin to be dealt with here, viz. Lochs Shiel and Dilate; one or two other small lochs within the basin (the principal one being Lochan Dubh, at the head of Glen Hurich) were not sounded.

Loch Shiel (see Plates I. and II.).—Loch Shiel is one of the larger Scottish fresh-water lochs, having a total length of 17½ miles. In this

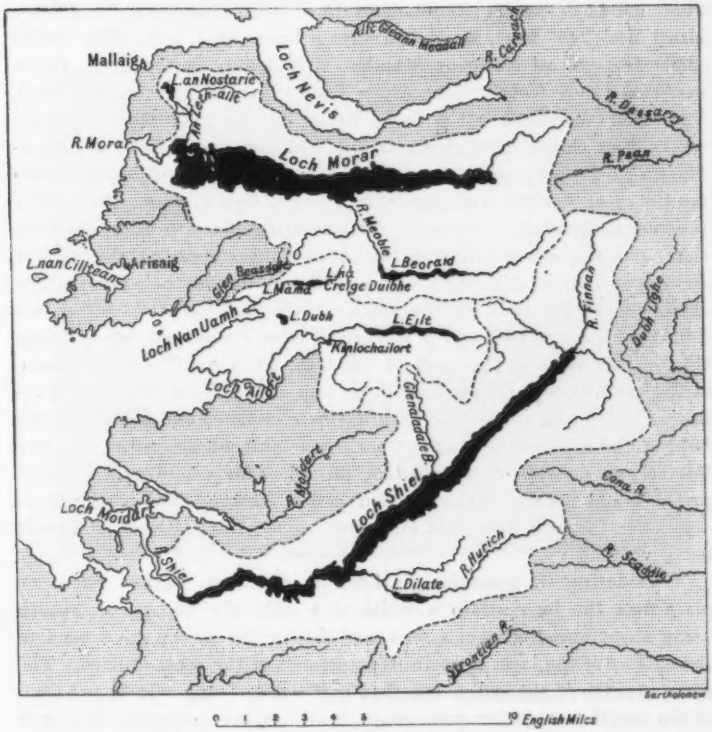


FIG. 1.—INDEX MAP OF THE SHIEL DISTRICT.

respect it is inferior only to Lochs Awe, Ness, and Lomond, which are 23, 22¾, and 22 miles in length respectively, and is closely followed by Loch Shin, which is 17¼ miles in length. Its elevation above the sea is only 11½ feet, so that a slight subsidence of the strip of land through which the river Shiel flows would convert it into an arm of the sea. Seals occasionally make their way into this loch from the sea at the present time. The principal upper portion of the loch trends in a

north-east and south-west direction, but about 6 miles above the outflow there is a bend in the outline of the loch, and the lower portion trends almost due west. The river Shiel follows a north-westerly course for about 2 miles before emptying itself into Loch Moidart. The scenery around the loch is very fine, becoming grand and wild towards the head. At the foot of the loch the surrounding ground is low, but on proceeding up the loch mountainous country borders the loch on both sides, culminating in heights exceeding 3000 feet at the head of Glen Finnan. To the south rises Ben Resipol (2774 feet), between Loch Shiel and Loch Sunart; to the east Sgor an Tarinachain (2474 feet), Meall Mor (2487 feet), Meall nan Creag Leac (2474 feet), Glas Garbh (2369 feet), Meall Doire na Mnatha (2094 feet); to the north Beinn nan Tom (2603 feet), Streap (2988 feet), Sgor Choileam (3164 feet), Sgor nan Coireachan (3133 feet), Fraoch-bheinn (2489 feet); to the west Beinn Odhar (2895 feet), Druim Fiaclach (2851 feet), a' Chroit-bheinn (2178 feet), and Beinn Gaire (2179 feet). The principal feeders are the river Finnan, Amhainn Shlatach, and Callop river, which enter the loch at its head, Glenaladale river entering about 6 miles down on the north-western shore, and the river Polloch (bearing the outflow from Loch Dilate) entering about 11 miles down on the south-eastern shore, where the bend in the trend of the loch occurs. There are numerous small islands and a few larger ones, the largest being Eilean Gleann Fhionainn at the head of the loch, while on Eilean Fhianain, at the narrows towards the foot of the loch, are the remains of St. Finnan's Church and a romantic burying-place of the Clanranald. At the head of the loch stands Prince Charlie's monument, erected by the late Colonel Macdonald, of Glenaladale, on the spot where that ill-fated prince raised his standard. Salmon, grilse, sea-trout, and brown trout abound in the loch, and yield fair sport, some of the salmon and trout being very heavy.

Considering its great length, Loch Shiel is very narrow, for at no place does the loch attain a width of a mile, the maximum breadth being about nine-tenths of a mile, and this occurs at the great bend in the outline of the loch, opposite the entrance of the river Polloch. The mean breadth of the loch is less than half a mile, being only $2\frac{1}{2}$ per cent. of the length—a smaller percentage than has been observed in any of the larger lochs surveyed by the Lake Survey, the lochs most nearly approaching it in this respect being Loch Shin with 3 per cent., and Loch Ness with 4·3 per cent. The waters of Loch Shiel cover an area of about 4840 acres, or over $7\frac{1}{2}$ square miles, and it drains directly an area of over $72\frac{1}{2}$ square miles, but, since it receives the outflow from Loch Dilate, its total drainage area is about $85\frac{1}{2}$ square miles—an area over eleven times greater than that of the loch. Over 700 soundings were taken, the maximum depth recorded being 420 feet, about 4 miles from the head of the loch, between the heights of Beinn a' Chaoruinn

and Beinn Odhar Bheag to the north-west, and of Meall nan Creag Leac to the south-east. The volume of water contained in the loch is estimated at 17,215 million cubic feet, and the mean depth at 81½ feet, or nearly 20 per cent. of the maximum depth. Loch Shiel was surveyed on July 2 to 9, 1902. The elevation of the lake surface above the sea was determined by levelling from bench-mark as being 11·4 feet; when levelled by the officers of the Ordnance Survey on November 6, 1897, the elevation was found to be 12 feet above sea-level. The water may rise 4 to 5 feet higher than the level given above.

The floor of Loch Shiel is on the whole rather irregular. The

FIG. 2.—LOCH SHIEL, FROM PRINCE CHARLIE'S MONUMENT.
(*Photo by T. N. Johnston, M.B., C.M.*)

50-feet contour-line encloses a continuous area extending from close to the upper end to within 2 miles from the lower end at Acharacle, but all the deeper contours are broken up so as to enclose two or more isolated areas. The 50-feet contour follows approximately the general outline of the loch, but it is in places of a sinuous character. At the head of the loch it extends both to the north-west and south-east of Eilean Ghleann Fhionainn. About 2 miles down there are sinuosities in the contour on both sides of the loch, due to a tongue of deep water projecting between the south-eastern shore and the island Sgeir Ghiubhsachain, and to a shoaling of the water off the north-western shore from 33 to 15 feet. Further down, off the north-western shore, above the entrance of the Glenaladale river, there is a twist in the 50-feet

contour, where the water shoals from 55 to 20 feet. Still further down, opposite the entrance of the Allt na Dalach, sinuosities in the 50-feet contour occur on both sides of the loch, the water shoaling off the south-eastern shore from 47 to 35 feet, and off the north-western shore from 41 to 19 and 22 feet. The last-mentioned shoaling occurs to the north-east of Eileanan Comhlach, at the entrance of the Allt a' Ghiubhais, and it is curious to observe a similar shoaling on the opposite (south-west) side of the island from 41 to 18 and 21 feet, while between the island and the mouth of the stream a depth of 32 feet was observed.

Towards the lower end of the wide part of the loch, and almost due south of Eilean Druim nan Laogh (or Heron island, as it is now called in the district), there is, near the middle of the loch, a shoal covered by only 2 or 3 feet of water. During the visit of the Lake Survey the regular mail steamer was laid up for repairs, having shortly before struck on this shoal and damaged the propeller. The captain of the steamer supplied information as to the position of the shoal, and the local gillie employed by the surveyors stated that in calm weather the bottom can be seen, but in the stormy weather prevailing at the time of the survey he was unable to find it, so that it must be of very small extent, for deep soundings were recorded near the spot indicated. The same gillie stated that a shoal bank extended from Ruadh Bac na Moine in an approximately south-west direction towards the opposite shore; this was confirmed by fishermen, and is probably indicated by the outward bend of the 50-feet contour-line at that place.

The 100-feet contour-line is less sinuous in character than the 50-feet contour, the main basin being about 12 miles in length, extending from near the head of the loch to the narrows at Eilean Fhianain, with two small subsidiary basins — one off Rudha Leathan, about $3\frac{1}{2}$ miles from the foot of the loch, based on a sounding of 112 feet; the other between the promontory on the south-eastern shore called Rudha Torr a' Chonnaidh and the outlying islands, about 7 miles from the head of the loch, based on a sounding of 148 feet. A remarkable rise of the bottom was observed within the main 100-feet basin, about a mile above the entrance of the river Polloch, where soundings of 84 and 43 feet were taken, surrounded on all sides by about 150 feet of water. The contour of the lake-floor along this line of soundings is shown in cross-section C–D on the map (Plate I.).

The main 200-feet basin is nearly 8 miles in length, approaching to within half a mile from the head of the loch, and extending as far down as Eileanan Comhlach. There are two small subsidiary basins, separated from the main basin by an interval of over half a mile, between the entrace of the Allt na Claise on the south-eastern shore and the entrance of the An Garbh-allt on the north-western shore. This line of soundings shows a curious configuration of the bottom, which rises in the central part of the loch and sinks again on both sides nearer the

shore: thus, on proceeding from south-east to north-west the water deepens to 201 feet, then shoals to 122 feet, then deepens again to 172, 209, and 224 feet, shoaling again towards the north-western shore. It is interesting to note the close proximity of these two small deep basins to the rise covered by 43 feet of water already mentioned. The 200-feet contour shows a peculiar loop off the north-western shore, about 4 miles from the head of the loch, where the water shoals from 199 to 163 feet.

FIG. 3.—LOCH SHIEL, FROM HIGH GROUND AT THE HEAD OF THE LOCH.
(*Photo by Mr. David Brigham.*)

The principal 300-feet basin is distant about a mile from the head of the loch, and extends down the loch for over 4 miles, enclosing the deepest parts of the loch. Separated from this basin by an interval of a quarter of a mile (in which the greatest depth is 282 feet) is a second small basin based upon a sounding of 307 feet, and after a similar interval (in which the greatest depth is 284 feet) there is a third 300-feet basin 2 miles in length, having a maximum depth of 385 feet. Within this third basin there is a slight rise of the bottom covered by 288 feet of water; the line of soundings on which this rise is situated is shown in cross-section E–F on map (Plate II.).

There are two small basins with depths exceeding 400 feet, the smaller about 3 miles from the head of the loch, based on soundings of 416 and 419 feet, separated by an interval of three-quarters of a mile (in which the greatest depth is 375 feet) from the larger, which is less than a mile in length and encloses the maximum depth of the loch (420 feet), recorded near the north-eastern end of this larger basin, and over 4 miles from the head of the loch. The line of soundings which includes the deepest one, is shown on cross-section G–H on map (Plate II.).

From the foregoing description, it will be noticed that in Loch Shiel the deeper water occurs towards the head of the loch. Proceeding from Acharacle at the foot of the loch, one must row 2 miles up before encountering a depth of 50 feet; a further $1\frac{1}{2}$ miles before meeting with a depth of 100 feet, and this merely a small patch, a further $1\frac{1}{2}$ miles having to be traversed before reaching the main 100-feet basin, or a total distance of 5 miles from the foot of the loch. The main 200-feet basin is distant about 9 miles, the lower 300-feet basin nearly 10 miles, and the principal 400-feet basin over 12 miles, from the foot of the loch.

The areas between the consecutive contour-lines drawn at equal intervals, and the percentages to the total area of the loch, are as follows :—

Feet.		Acres.		Per cent.
0 to 100	... ...	2652	...	54·4
100 „ 200	... ...	968	...	20·0
200 „ 300	... ...	711	...	14·7
300 „ 400	... ...	484	...	10·0
over 400	... ...	45	...	0·9
		4840		100·0

This table shows that more than half of the entire floor of Loch Shiel is covered by less than 100 feet of water, and about three-fourths by less than 200 feet, while only 1 per cent. is covered by water exceeding 400 feet in depth. The slope of the bottom is on the whole gentle, but in certain places deep water was found comparatively close inshore, and the consequent crowding of the contour-lines indicates a steeper slope than usual in these positions.

Temperature Observations.—Numerous observations were made on the temperature of the surface water of Loch Shiel during the week spent on the survey, the range observed being 8°·2, from 54°·2 to 62°·4. Three serial temperatures were taken beneath the surface, with the following results :—

TABLE OF SERIAL TEMPERATURES TAKEN IN LOCH SHIEL.

Depth in feet.	July 5, 1902, 6 p.m. Off Scamodale.	July 8, 1902. Off Eilean Druim nan-Laogh.	July 9, 1902, 5 p.m. 3 miles from head of loch.
	° Fahr.	° Fahr.	° Fahr.
0	57·1	55·9	56·5
5	—	54·9	—
10	57·0	54·5	—
20	56·3	54·4	56·5
30	55·5	—	—
50	50·2	54·0	56·0
75	—	50·9	—
100	47·0	47·0	47·4
130	—	46·2	—
200	45·7	—	45·2
280	45·3	—	—
300	—	—	45·2
400	—	—	45·3

In this table the observations are arranged chronologically, but the series given in the first column was taken about midway between the other two series, the second column giving a series taken towards the foot, and the third column a series taken towards the head, of the loch. The central series in the first column was taken three days earlier than the others, and is therefore not strictly comparable; it shows a higher temperature in the surface waters, and a lower temperature at a depth of 50 feet, than in either of the others. The temperature observed near the foot of the loch was lower at all depths than that observed towards the head, the difference amounting to 2° at 20 and at 50 feet, and to 0°·4 at 100 feet. The most pronounced fall in temperature was recorded between 50 and 100 feet towards the two ends of the loch, but between 30 and 50 feet in the central series (first column). The range of temperature shown by these serial observations is about 12°, while the extreme range of all the observations from surface to bottom during the week spent on the survey is over 17°.

Loch Dilate (see Plate III.).—Loch Dilate (or Doilate) lies about 1½ miles to the east of the lower portion of Loch Shiel, into which it flows by the river Polloch entering Loch Shiel about 6 miles above its outflow. The ground between the two lochs is low, the fall from Loch Dilate to Loch Shiel being only 10½ feet, but high and mountainous country surrounds Loch Dilate in all other directions. The principal feeder is the river Hurich, which takes its rise in Lochan Dubh at the head of Glen Hurich, and after a course of 6 miles empties itself into the east end of Loch Dilate. The loch trends east and west, and is nearly 1½ miles in length. It is widest towards the east end, where the maximum breadth is over one-third of a mile, the mean breadth being about one-seventh of a mile. Its waters cover an area of about 142 acres, or nearly a quarter of a square mile, and it drains an area fifty-eight times greater, or nearly 13 square miles. Forty-five

soundings were taken in Loch Dilate, the maximum depth observed being 55 feet. The volume of water contained in the loch is estimated at 145 million cubic feet, and the mean depth at 23½ feet, or 43 per cent. of the maximum depth. The loch was surveyed on July 8, 1902, and the elevation of the lake surface above the sea by levelling from bench-mark was found to be 22 feet. When levelled by the officers of the Ordnance Survey on October 16, 1867, the elevation was found to be 23·4 feet above sea-level.

Loch Dilate forms a simple basin, the deeper water being centrally placed, and the contour-lines following approximately the outline of the loch. A sounding of 12 feet was recorded off the bay in the south-east corner of the loch, apparently surrounded by shallower water, though possibly continuous with the 10-feet area, but this is the only irregularity in the lake-floor indicated by the soundings. Along the central portion of the southern shore the contour-lines closely hug the shore, indicating a comparatively steep slope in this locality. A section along the central line of the loch from west to east is shown in section A–B on the map. The areas between the contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.	Acres.	Per cent.
0 to 25	78 ...	55·4
25 „ 50	49 ...	34·3
Over 50	15 ...	10·3
	142	100·0

Temperature Observations.—The following serial temperatures were taken at 3 p.m. on July 8, 1902, in the deepest part of Loch Dilate:—

Surface	62°·3 Fahr.
10 feet	62°·3 „
20 „	62°·3 „
25 „	61°·5 „
30 „	55°·3 „
50 „	53°·3 „

This series shows a constant temperature from the surface down to a depth of 20 feet, a slight fall of 0°·8 between 20 and 25 feet, then a very rapid fall of 6°·0 between 25 and 30 feet (a fall exceeding 1° per foot of depth), and a further fall of 2° between 30 and 50 feet, the extreme range of temperature being 9° Fahr.

2. *Ailort Basin.*

Loch Eilt is the only loch to be dealt with here; the few very small hill lochs within the basin were not surveyed.

Loch Eilt (see Plate IV.)—Loch Eilt lies about 1½ miles to the east of the head of Loch Ailort (into which its outflow is carried by the river Ailort), and about 4 miles to the west of Glenfinnan. The hills

around it rise steeply up to a height of over 1500 feet, the highest points exceeding 2000 feet. It was formerly considered a good loch for salmon and sea-trout; but Mr. Harvie-Brown believes that the blasting operations during the construction of the Mallaig extension of the West Highland railway resulted in the destruction of a large amount of spawn and fry, and that now the fish are greatly disturbed by the passage of the trains across the bays on the south shore.

Loch Eilt trends east and west, and is $3\frac{1}{3}$ miles in length, with a

FIG. 4.—LOCH EILT, LOOKING EAST.

(*Photo by Mr. David Brigham.*)

maximum breadth of half a mile, the mean breadth being one-fifth of a mile. Its waters cover an area of about 424 acres, or two-thirds of a square mile, and it drains an area of 12 square miles. Over 250 soundings were taken, the maximum depth recorded being 119 feet. The volume of water contained in the loch is estimated at 686 million cubic feet, and the mean depth at 37 feet. The loch was surveyed on July 9 and 10, 1902; the elevation of the lake-surface was found, by levelling from bench-marks, to be 96·4 feet above the sea. The keeper stated that the water might rise about 3 feet above, and fall about

9 inches below, this level. During the night of July 9 and 10, 1902, the water rose nearly 10 inches.

Loch Eilt is naturally divided into three portions by two narrow constrictions in its outline, the western portion being by far the largest and deepest, covering an area of about 360 acres, while the area of the central and eastern portions is in each case about 32 acres. The western portion is connected with the central portion by a channel 6 feet in depth, with a rocky islet in the centre, the sides of the channel being also of rock *in situ*, thus dividing the loch into two rock-basins; the central portion is separated from the eastern portion by detritus brought down by the Allt a' Choire Bhuidhe, the channel between them having a depth of 7 feet. The small eastern and central basins are quite simple in conformation, the maximum depth observed in the eastern one being 52 feet, and in the central one 70 feet. The floor of the large western basin is much more irregular, there being four areas with depths exceeding 50 feet: (1) a small area near the east end, based on a sounding of 52 feet; (2) the main 50-feet area, which encloses the deepest part of the loch, over a mile in length, and with a rocky islet rising to the surface near its western margin; (3) a small area between the large island (Eilean Mòr) and the northern shore, based on a sounding of 55 feet; and (4) a small area near the west end, based on two soundings of 55 feet. At the extreme west end of the loch, between the two islands, a depth of 40 feet was recorded. The 75-feet area is about half a mile, and the 100-feet area about a quarter of a mile, in length, occupying the wide central part of the western basin, but rather nearer the east than the west end. The deepest part of the loch falls below sea-level (the 100-feet contour-line corresponding approximately with the level of the sea), and is flat-bottomed in character, as shown in cross-section C–D on the map.

The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.		Acres.		Per cent.
0 to 25	...	187	...	44·1
25 „ 50	...	111	...	26·0
50 „ 75	...	88	...	20·9
75 „ 100	...	20	...	4·8
Over 100	...	18	...	4·2
		424		100·0

Temperature Observations.—The temperature of the surface water in Loch Eilt during the two days spent on it varied from 58° to 60° Fahr., while the air-temperature varied from 53°·5 to 57°·9. On July 10, 1902, three series of temperatures were taken beneath the surface, one in each of the three basins into which the loch is divided, with the following results:—

Depth in feet.	Loch Eilt (eastern basin). July 10, 1902, 2.30 p.m.	Loch Eilt (central basin). July 10, 1902, 3.30 p.m.	Loch Eilt (western basin). July 10, 1902, 5 p.m.
	° Fahr.	° Fahr.	° Fahr.
Surface	58·0	58·1	60·0
10	58·0	58·1	60·0
20	58·0	58·1	60·0
27·5	55·7	57·7	60·0
35	52·8	53·6	59·7
50	50·7	52·8	54·8
75	—	—	53·0
100	—	—	51·0

These series show a constant temperature down to 20 feet in each case, but the water in the deep western basin was 2° warmer than in the other two basins. Beyond the depth of 20 feet, again, the temperature was about 2° higher in the western basin than in the central basin, and 2° higher in the central basin than in the eastern basin, so that at a depth of 100 feet in the western basin the temperature was rather higher than at a depth of 50 feet in the eastern basin. The water in the western basin was warmer at all depths than that in the central basin, and in the central basin than in the eastern basin. To explain this peculiar distribution of temperature in the waters of Loch Eilt on the afternoon of July 10, 1902, the weather conditions during the few preceding days must be taken into account. The wind had been blowing strong from the north-east from the 3rd till the afternoon of the 9th. Rain commenced to fall about 6 a.m. on the 9th, and continued till about 8 a.m. on the 10th, so that during the twelve hours from 9 p.m. on the 9th to 9 a.m. on the 10th the surface of the loch rose $9\frac{3}{4}$ inches. About 11.30 a.m. on the 10th the wind rose from the west, and by 4 p.m. was blowing a gale, so much so that the greatest difficulty was experienced in keeping the boat in position for the 5 p.m. series of temperatures. It would thus appear that the easterly winds of the previous week had blown the warm surface water into the western portion of the loch, and the west wind of the 10th had not yet had time to reverse this effect; the fact that the area draining into the western basin is nearly double that draining into the other two basins would doubtless accentuate this result, since more water would enter the western basin than the other basins, and this inflowing water at this season of the year would be warmer than the water of the loch. The range of temperature from surface to bottom in the eastern basin was 7°·3 Fahr., the greatest fall being 5°·2 between 20 and 35 feet; in the central basin the range was 5°·3, the greatest fall being 4°·5, also between 20 and 35 feet; in the western or main basin the range was 9° (representing the extreme range observed throughout the entire loch), and the greatest fall was 4°·9 between 35 and 50 feet.

3. *Lochs of the nan Uamh Basin.*

The lochs to be dealt with here are Loch Dubh, between the head of Loch Ailort and the head of Loch nan Uamh, and Lochs Màma and na Creige Duibhe lying to the north-east. Loch Doir' a' Gherrain in Ardnish could not be sounded, because there was no boat on it at the time of the visit of the Lake Survey.

Loch Dubh (see Plate V.).—Loch Dubh is a small loch situated at the head of the peninsula of Ardnish, which separates Loch Ailort from Loch nan Uamh, the two branches of the Sound of Arisaig. The Mallaig extension of the West Highland railway runs along its southern shore, and the outfall flows through the old bed of the little Lochan Deabhta, which has been completely drained by the railway, leaving only a channel through it for the escape of the waters from Loch Dubh. After leaving Lochan Deabhta the outfall joins the Schoolhouse burn, which has been deflected, thence into the Arnabol burn, falling into the head of Loch Beag, an inlet of Loch nan Uamh. It is surrounded, except on the western side, by low though steep hills, which impart a dark and sullen appearance to the loch, hence its name—the Black loch. Considering its superficial area, it is the deepest loch visited by the Lake Survey.* Its great depth, and the remarkable temperature conditions discovered in it, well repaid the trouble of carting a boat from Loch nan Uamh and carrying it down to the loch. Its catchment area is very small, and it would seem that the unpleasant taste of its water, resembling that of a stagnant pool, is due to the small amount of fresh water entering it. This unpleasantness is probably something more than mere taste, for attempts to stock the loch with trout have been unsuccessful, the fish rapidly dying; eels, however, abound in it.

Loch Dubh trends in a north-west and south-east direction, the broadest part being rather near the south-east end. Its length is under half a mile, its maximum breadth one-sixth of a mile, and its mean breadth one-tenth of a mile. Its waters cover an area of about 32 acres, and it drains an area eight times greater, or about 262 acres. Sixty-five soundings were taken, and the maximum depth observed was 153 feet, which bears the ratio to the length of the loch of 1 to 15. This low ratio is only equalled by the little loch on Eilean Subhainn in Loch Maree, and the loch which most nearly approaches it is Loch Fender in the Tay basin, in which the ratio is as 1 to 22, followed by Loch Dhugaill, near Kishorn, in which the ratio is as 1 to 27. Among the larger Scottish lochs, the nearest approach is found in Loch Treig, with a ratio of depth to length of 1 to 62. The volume of water

* The deepest lake in East Prussia is, according to Halbfass (*Globus*, Bd. 86, p. 187, September 15, 1904), the Wuchsnigsee, which is about 1¼ miles in length, and has a maximum depth of about 210 feet. Loch Dubh is less than half a mile in length, and its maximum depth is 153 feet.

contained in the loch is estimated at 86,956,000 cubic feet, and the mean depth at nearly 63 feet, or 41 per cent. of the maximum depth. The loch was surveyed on July 12, 1902; the elevation of the lake surface above the sea was found, by levelling from bench-marks, to be 103 feet; when visited by the Ordnance Survey officers on August 6, 1869, the elevation was 103·3 feet above sea-level. No drift-marks were seen, but the keeper stated that the annual range in level was about 9 inches.

Loch Dubh is very simple in conformation, the contour-lines following approximately the shore-line. Near the north-west end there is a slight rise of the bottom, as shown in section A–B on the map, but otherwise the lake-floor slopes down regularly to the deepest part, which lies towards the north-eastern shore. The maximum depth of 153 feet was observed at a distance of about 120 feet from this shore, giving a slope of 59°; the height of the hill immediately adjoining is 240 feet, and the slope 35°, hence the slope from the top of the hill to the bottom of the loch is one of 45°. The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows :—

Feet.	Acres.	Per-cent.
0 to 50	14·8 ...	40·7
50 „ 100	8·9 ...	30·9
100 „ 150	7·6 ...	26·5
Over 150	0·5 ...	1·9
	31·8	100·0

Temperature Observations.—A most interesting series of temperatures was taken in Loch Dubh at the time of the survey, as given in the first column of the following table. The loch was revisited in March, 1903, when the water was found to be uniform in temperature from surface to bottom, as given in the second column of the table—

Depth in feet.	Loch Dubh. July 12, 1902, 3 p.m.	Loch Dubh. March 28, 1903.
	° Fahr.	° Fahr.
0	59·0	41·0
10	59·0	—
16	58·9	—
20	56·0	—
25	53·7	—
35	51·5	—
50	47·1	41·0
75	44·1	41·0
100	43·6	40·9
150	43·5	40·9

The series taken in March calls for no discussion, but the series taken in July is remarkable for the low temperature of the deep water at this season of the year, and for the great range of temperature from surface to bottom. Compared with the temperatures recorded in Loch Shiel a week earlier in the same month, we find the temperature in

Loch Dubh 1°·7 lower at the bottom in 150 feet than in Loch Shiel in 420 feet, and in Loch Morar (the deepest of all Scottish lochs), ten days earlier in the same month, a temperature equal to that at the bottom of Loch Dubh was recorded only after descending to a depth of 250 feet. The extreme range of temperature shown by the series in Loch Dubh amounts to 15°·5, while the series taken in Loch Shiel shows a range of only 12°, and the series in Loch Morar shows a range of only 13° from surface to bottom. The extraordinary temperature conditions observed in Loch Dubh may probably be accounted for (1) by the great depth of the loch compared with other lochs of similar area; (2) by the small extent of its drainage area, so that very little rain-water enters the loch; and (3) by the small area of the loch and the steepness of the surrounding hills reducing the mixing effect of the wind to a minimum.

Lochs Màma and na Creige Duibhe doubtless formed at no distant date one sheet of water, which was gradually separated into two portions by the deposition of material brought down by the Allt Dearg. This is evidenced by the fact that locally the name Màma is applied to both divisions, but in this place that name is restricted to the western basin, the name na Creige Duibhe being applied to the larger and deeper eastern basin. The connecting stream is about 60 yards in length, with a depth of 7 to 8 feet, the fall from Loch na Creige Duibhe to Loch Màma being less than a foot. The tract of alluvium separating the two lochs was about 2½ feet above the water of Loch Màma, and the keeper stated that he had often seen it flooded when the lochs were high. The hills along the northern and southern shores of the lochs rise steeply up to heights exceeding 1000 feet, approaching 2000 feet along the northern shores, down the sides of which a few torrents rush after heavy rains. The two lochs trend east and west, and the outflow from Loch na Creige Duibhe passes into Loch Màma, and thence by the Gleann Màma into Loch nan Uamh.

Loch Màma (see Plate V.).—Loch Màma is over one-third of a mile in length, one-eighth of a mile in maximum breadth, and one-twelfth of a mile in mean breadth. Its waters cover an area of about 17 acres, and it drains directly an area of two-thirds of a square mile, but since it receives the outflow from Loch na Creige Duibhe its total drainage area is over 2 square miles, an area seventy times greater than that of the loch. Nearly forty soundings were taken, the maximum depth observed being 44 feet. The volume of water contained in the loch is estimated at 11 million cubic feet, and the mean depth at 14¼ feet. The loch was surveyed on July 11, 1902, and the elevation of the lake surface above the sea was determined from spot-levels as being 359 feet. It forms a simple basin, the deepest part being found towards the east end. The areas between the contour-lines, and the percentages to the total area, are as follows:—

Feet.		Acres.		Per cent.
0 to 10		8·0	...	46·9
10 „ 25		6·4	...	37·5
Over 25		2·6	...	15·6
		17·0		100·0

Loch na Creige Duibhe (see Plate V.).—Loch na Creige Duibhe is four-fifths of a mile in length, one-eighth of a mile in maximum breadth, and one-fourteenth of a mile in mean breadth. Its waters cover an area of about 36½ acres, and it drains an area twenty-four times greater, or about 1½ square miles. Over seventy soundings were taken, the maximum depth recorded being 93 feet. The volume of water is estimated at 52 million cubic feet, and the mean depth at 32½ feet. The loch was surveyed on the same day as Loch Màma (July 11, 1902); the elevation of the lake surface above the sea, from spot-level and by comparison with Loch Màma, was found to be 359·7 feet. An inspection of the map shows Loch na Creige Duibhe to be (like Loch Màma) a long narrow basin of very simple conformation. It is much deeper than Loch Màma, and the deeper water approaches nearer to the west than to the east end, that is to say, nearer to the alluvial cone separating the two lochs. A similar state of matters has been noted in the case of Lochs Voil and Doine in the Forth basin, formerly a continuous loch, now divided into two portions by the deposition of material brought down by the river, where deep water approaches close to the dividing promontory of land on both sides.*

The areas between the consecutive contour-lines drawn in at equal intervals, and the percentages to the total area of the loch, are as follows:—

Feet.		Acres.		Per cent.
0 to 25		21·2	...	58·1
25 „ 50		6·9	...	19·0
50 „ 75		5·1	...	14·1
Over 75		3·2	...	8·8
		36·4		100·0

Temperature Observations.—The surface temperature observed in Loch na Creige Duibhe on the date of the survey was 57°·4, in the stream between the two lochs 57°·1, and in Loch Màma 56°·5. The following serial temperatures were taken in the deepest part of Loch na Creige Duibhe at 4·45 p.m. on July 11, 1902:—

Surface	57°·4 Fahr.
10 feet	57°·4 „
20 „	57°·4 „
30 „	53°·0 „
50 „	50°·8 „
75 „	49°·2 „
90 „	48°·8 „

* See *Geographical Journal*, vol. 15, p. 325, April, 1900.

SUMMARY TABLE.

Giving Details concerning the Lochs described in this Paper.

Loch.	Height above sea. Feet.	Number of soundings.	Length in miles.	Breadth in miles.		Mean breadth per cent. of length.	Depth.			Ratio of depth to length.		Volume in million cubic feet.	Area in square miles.	Drainage area.	
				Max.	Mean.		Max. Feet.	Mean Feet.	Mean per cent. of max.	Max.	Mean.			Total in square miles.	Ratio to area of loch.
Shiel	11·4	715	17·40	0·88	0·43	2·5	420	81·65	19·4	219	1125	17,215	7·56	85·42	11·30
Dilate	22·0	45	1·43	0·37	0·15	10·5	55	23·50	42·7	137	321	145	0·22	12·81	58·23
Eilt	96·4	254	3·37	0·51	0·20	5·8	119	37·12	31·2	149	479	686	0·66	12·05	18·26
Dubh	103·0	65	0·43	0·17	0·10	23·2	153	62·70	41·0	15	36	87	0·05	0·41	8·20
Na Creige Duibhe ...	359·7	74	0·80	0·13	0·07	8·7	93	32·49	34·9	45	130	52	0·06	1·46	24·33
Màma	359·0	38	0·37	0·13	0·08	21·6	44	14·29	32·5	44	137	11	0·03	2·09	69·66
		1191										18,196	8·58	99·97 *	11·65

* The drainage area of Loch Dilate is included in that of Loch Shiel, and that of Loch na Creige Duibhe in that of Loch Màma.

This series shows a constant temperature down to 20 feet, then a fall of 4°·4 between 20 and 30 feet, and a further fall of 2°·2 between 30 and 50 feet, the extreme range of temperature from surface to bottom being 8°·6.

The details regarding the lochs dealt with in this paper are collected together in the table on the opposite page for convenience of reference and comparison.

From this table it will be seen that in the six lochs under consideration nearly 1200 soundings were taken, and that the aggregate area of the water surface is over 8½ square miles, so that the average number of soundings per square mile of surface is 139. The aggregate volume of water contained in the lochs is estimated at about 18,200 millions of cubic feet. The area drained by these lochs is nearly 100 square miles, or 11½ times the area of the lochs.

Geology of the Loch Shiel Catchment Basin.—Though the basin of Loch Shiel has not been surveyed by the Geological Survey, we understand that certain members of the staff have examined the rock cuttings on the line of railway between Loch Eil and Kinlochailort. The rocks exposed in these cuttings consist of muscovite-biotite gneiss and flaggy mica-schists, which are included in the Moine series of crystalline schists by the Geological Survey. The general strike of these strata is north-east and south-west, so that in all likelihood they are continued to the south-west along both sides of Loch Shiel. This conclusion is supported by the fact that on the lofty watershed between Loch Shiel and Loch Linnhe these muscovite-biotite gneisses have been mapped by the Geological Survey. These schists and gneisses, which are supposed to represent altered sediments, are traversed by numerous veins of pegmatite and dykes of diorite, dolerite, and basalt.

On the watershed between Glen Hurich and Glen Scaddle, on the crest of Sgor Dhomhail (2915 feet), there is a mass of foliated granite, and, further to the south-west, the later igneous intrusions of the Strontian district may enter the Loch Shiel catchment basin.

NOTES ON THE BIOLOGY OF THE LOCHS IN THE SHIEL DISTRICT.

By JAMES MURRAY.

Of the six lochs dealt with in this paper, tow-nettings were taken in four, and a shore-netting in a fifth. The biology presented little of special interest. *Diaptomus laciniatus* was found in two of the lochs (Shiel and Eilt); these are the most southerly lochs in which this northern species was observed by the Lake Survey, though it has been recorded by Dr. Scott from one loch (Loch Doon) much farther south.

Loch Shiel.—Owing to the great abundance of *Holopedium*, which choked up the nets, it was difficult to collect other animals in any numbers. The most plentiful animals were: *Diaptomus gracilis, Diaptomus laciniatus, Cyclops strenuus, Bosmina obtusirostris, Bythotrephes, Polyphemus*, six species of pelagic Rotifers (including *Floscularia pelagica*) and *Dinobryon*. The plants noted were: *Xanthidium antilopeum, Staurastrum gracile*, and *Staurastrum braziliense*. *Lobelia* and *Littorella* were in flower at the upper end of the loch.

Loch Dilate.—As compared with Loch Shiel, the most notable features of this loch were: the greater abundance of life, the absence of *Holopedium* and *Diaptomus laciniatus*, and the presence of *Diaphanosoma brachyurum* in considerable numbers. Among the organisms observed were: *Diaptomus gracilis*, *Cyclops strenuus*, *Synchæta pectinata*, *Plœsoma truncata*, *Dinobryon*, *Peridinium*, two species of *Ceratium* (*C. hirundinella* and *C. cornutum*), *Anabæna flos aquæ* with its adherent *Vorticellæ*.

Loch Eilt.—Life was abundant, the characteristic animals being *Holopedium*, *Diaptomus laciniatus*, *Cyclops strenuus*, *Anuræa cochlearis*, *Notholca longispina*, and *Polyarthra*. *Leptodora* and *Bythotrephes* were scarce. *Bosmina obtusirostris* and a variety approaching *B. longispina* were seen. The brilliant red and blue Rotifer, *Notops pygmæus*, was plentiful. Some immature specimens of *Diaptomus* probably belonged to *D. gracilis*. On the mud in the deepest part of the loch were numbers of a pretty little green larva of an insect, enclosed in transparent flask-shaped cases.

Loch Dubh.—This little loch, remarkable for its great relative depth and temperature conditions, resembling those in a great lake, was examined on two occasions. On the first visit in July, 1902, the surface temperature was 59° Fahr., while on the second visit in March, 1903, the temperature throughout was about 41° Fahr. Notwithstanding this difference in temperature there was little difference in the animals observed on the two occasions. Those found in July were: *Diaptomus gracilis* (blue and red, grey, red, blue), *Cyclops strenuus*, *Bosmina obtusirostris* (small, purple), *Daphnia lacustris* (all pale red), *Eurycercus*, *Polyphemus*, *Triarthra*, *Polyarthra*, *Anuræa cochlearis*, *Conochilus*, *Ceratium hirundinella*, *Dinobryon*. In March all the same animals were found, except *Polyphemus*, and there were in addition a few larvæ of *Corethra* (phantom larvæ), *Notholca foliacea*, a second species of *Ceratium* (*C. cornutum*—less common in lakes), *Mallomonas*. A very small form of *Asterionella* occurred. Near the shore large spheres of *Ophridium* were found on the weeds. In the mud from the bottom were many Rhizopods of the species *Cyphoderia ampulla*, *Difflugia pyriformis*, *D. globulosa*, and *D. arcula*. *Lobelia* and *Myriophyllum* were growing along the shores.

Loch na Creige Duibhe.—As this loch was only examined by means of a net thrown out from the shore, it is probable that some of the pelagic animals may have been missed. The animals seen were: *Diaptomus gracilis* (reddish), *Cyclops strenuus* (yellow), *Alonopsis elongata*, *Chydorus sphæricus*, *Anuræa cochlearis*, *Bosmina obtusirostris*, *Arcella vulgaris*. A few of the commonest filamentous Algæ and Desmids were seen. *Asterionella* was scarce.

A JOURNEY TO LAKE SAN MARTIN, PATAGONIA.

By Captain H. L. CROSTHWAIT, R.E.

THIS journey was undertaken in connection with the demarcation of the Chile-Argentine boundary. Before, however, landing in Patagonia, we made a short trip through the channels of Tierra del Fuego on board the Argentine cruiser *Nuevo de Julio*, Captain Quiroga, which had been placed at the disposal of Sir Thomas Holdich.

The first place we touched at was New Year island, a small island situated in lat. 54° 59′ S., about 5 miles off the north coast of Staten island. Our object was to visit the magnetic and meteorological observatory established there by the Argentine Government, as a base observatory, in connection with the Antarctic Expedition, then in

FIG. 1.—MAGNETIC AND METEOROLOGICAL OBSERVATORY, NEW YEAR ISLAND.

FIG. 2.—BEAGLE CHANNEL.

FIG. 3.—USHUAIA, BEAGLE CHANNEL.

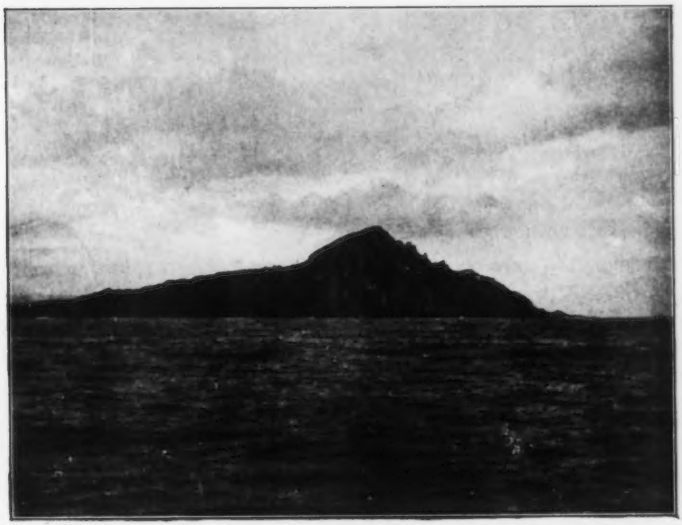


FIG. 4.—CAPE HORN.

FIG. 5.—GLACIER DESCENDING TO THE SEA.

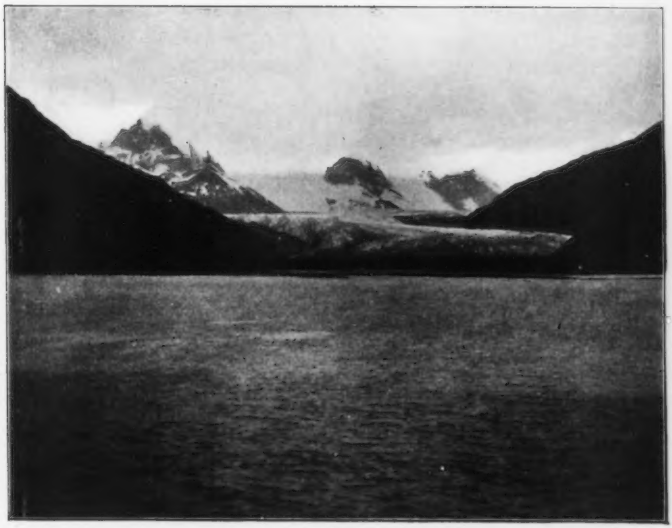


FIG. 6.—ROMANCHE BAY GLACIER, BEAGLE CHANNEL.

FIG. 7.—GLACIERS DESCENDING FROM MOUNT SARMIENTO.

progress under Dr. Nordenskjöld. This is a most complete observatory in every respect. It is superintended by four Argentine naval officers, who, in the interests of science, exile themselves on this lonely and desolate spot. The attention they give to their work is well illustrated by the fact that they never allow the annual range of temperature in the magnetic observatory to exceed 1° C. The following temperature conditions have been recorded on this island, as given me by the officer in charge, since the observatory was opened in February, 1902: Highest recorded, 55°·4 Fahr.; lowest, 16°·4 Fahr.; annual mean, 41° Fahr. The magnetic observatory is kept at an almost constant temperature of 64° Fahr.

Staten island was just visible through the mist. An intense gloom, beyond all description, seems to overhang this place, which makes it look like the confines of the world. Entering the Straits of Le Maire, we steamed into Beagle channel, anchoring that night off the flourishing settlement of Harberton, belonging to Messrs. Bridges, who employ on their farms a number of Ona Indians.

It is not easy to estimate the number of Indians now inhabiting Tierra del Fuego. Mr. Bridges thinks there are about 500 Onas; Mr. W. S. Barclay puts down the Yaghans at 200, and the Alacalufs at 800. This makes a total Indian population of about 1500. Formerly it was estimated at 8000 ('Encl. Brit.'), but it is difficult to believe that such a sterile land, with an inhospitable climate, could have ever supported a large population.

Continuing up Beagle channel, we reached Ushuaia. This place was established a few years ago as a naval station, and is now the seat of the Government of the Argentine portion of Tierra del Fuego. We were here, as elsewhere, most hospitably entertained by the governor.

Shortly after leaving Ushuaia we turned south through Ponsonby sound—the home of "Jemmy Button"—a very narrow channel between Naverine and Hoste islands. In the afternoon we reached Tekineka bay, where the South American Mission has a station and a church—the most southern church in the world. There live here, under the care of Mr. Williams, the missionary, about seventy Yaghan, or canoe Indians.

Leaving this damp and dreary bay, we passed False Cape Horn, and, skirting the west end of Hermite island, made straight for the Horn itself. There was little wind, but a long unpleasant swell was running. Having taken a good look at, and some photographs of, this famous but very ordinary promontory, we turned northward and anchored for the night in Goeree roads, between Naverine and Lennox islands.

The next place of interest was Sloggett bay, where gold-washing is carried on in a most primitive manner by a party of miners, mostly runaway sailors, of various nationalities. Geologically the shores of the bay appear to be formed by the upraised delta of a river, or several rivers, which once flowed into the sea here. These seem now to be

lost in a great swamp, which covers the alluvial deposit with a thick layer of peat. The sea face is a vertical cliff about 100 feet high. At the base is rock, above this the alluvial deposit, and over all a covering of peat. As the waves undermine the cliff, the gold-bearing gravel falls on the beach below. The sea, acting on the *débris* like a natural jigger, concentrates the gold a few feet below the surface. This material the miners further concentrate by washing, and thus obtain small quantities of gold—enough, it was said, to provide a living wage. So far as I know, no scientific attempt has been made to deal with this large quantity of gold-bearing material. Whether it would pay is another matter. Owing to its remote existence, and other drawbacks, probably it would not.

The most striking feature of Beagle channel is undoubtedly the astonishing number and variety of the glaciers, which occupy all the valleys descending from every mountain high enough to be covered with a mantle of perpetual snow. The general direction of these valleys is favourable as regards shelter from the summer sun. This fact, no doubt, accounts in a measure for the great extension of the glaciers. The coolness of the summer rather than the severity of the winter is also an important factor in maintaining both the glaciers and the comparatively low snow-line, which cannot be much more than 2000 feet above sea-level. It is to these features we must look in endeavouring to explain the glaciers of Tierra del Fuego.

Most of the larger glaciers we saw showed signs of shrinkage. Trees grow on the lower and older terminal moraines, the vegetation becoming younger as the actual ice-wall is approached. Lateral moraines are found stranded on the flanks of the valleys, high above the present level of the ice, and the polished rock indicates the height to which the glacier had once reached. These features were particularly noticeable in the case of the glacier opposite Romanche bay, and the large glacier descending from Mount Sarmiento. The question of the general recession of glaciers in these regions is an interesting one for future investigation, and Beagle channel forms an admirable field for study.

Navigation is not possible at night in these narrow seas. We therefore anchored every evening in some friendly cove. Often from within the shelter of these deep indentations we heard the storm raging overhead, only occasional and fitful gusts of wind reaching the ship. Now and then the crash of ice falling from neighbouring glaciers resounded among the mountains.

During our stay in Tierra del Fuego from January 15 to the 27th, 1903 (corresponding to July), the mean maximum temperature was 56°·2 Fahr., and the mean minimum 46°·7 Fahr., as recorded on board ship.

* * * * * *

Shortly after landing in Patagonia, at Puerto Consuelo in Last

FIG. 8.—BAGUALES RANGE.

FIG. 9.—BAGUALES RANGE.

FIG. 10.—CAMP NEAR TOP OF BAGUALES RANGE.

FIG. 11.—RIO SANTA CRUZ.

FIG. 12.—MOUTH OF RIO LEONA, LAKE ARGENTINA.

FIG. 13.—CLAY FORMATION, RIO LEONA.

Hope inlet, we visited the now famous Cave of the Mylodon. It is fairly well worked out as regards the larger remains of the giant sloth; there are, however, still to be found pieces of the skin with the hair on of this extinct animal. The explanation of this high state of preservation in which it is found, may be sought in the stalagmite which covers the floor of the cave. There are said to be other caves in the neighbourhood, but the few men who make a business of discovering and disposing of mylodon remains do not encourage exploration.

On February 10, 1903, I left the Chief Commissioner, Sir Thomas Holdich, at Camp Cazador, in lat. 51° S., and started for Lake San Martin. The route lies across a pass over the Baguales range. This range leaves the continental water-divide in the neighbourhood of Mount Stokes, projecting into the Pampas in a direction almost at right angles to the general line of cordilleras. The formation is basaltic, to which must be attributed its extraordinary appearance. As we entered the narrow valley leading to the pass, high pointed pinnacles and minarets towered above us, assuming all kinds of fantastic shapes and forms—some like vast cathedrals, others resembling mediæval forts. The pass, which is 4100 feet above sea-level, was just free from snow, though patches were lying about in sheltered places.

The march next day was begun in a snowstorm, and during the night the temperature had fallen to 30° Fahr. However, as we descended the weather cleared, and towards the afternoon we had a splendid view of Lake Argentino. Below us, stretching east and west, lay the great lake, about 60 miles long and 10 to 20 broad. The western end has several arms penetrating deep into the recesses of the cordilleras, and there receive the water of numerous glaciers. Large icebergs were floating on the lake, drifting with the prevailing wind towards the east. Slowly turning round, they exhibited in the glistening sunlight every gradation of colour from blue to green.

In the evening we camped on the shores of a bay. The water was covered with ducks, black-necked swans, and geese. These birds, as indeed all animals in Patagonia, are so unsophisticated from never having seen human beings, that they allow one to approach quite close without attempting to escape. I noticed this particularly with the huemul round Lake San Martin, but it seemed to be prompted by an insatiable curiosity. Under these circumstances sport, in its true sense, is impossible. Snipe were also fairly plentiful on the shores of the lake. They resemble the English variety, but fly slowly and never very far. I often found them in places high up on the hillsides, quite devoid of water.

The shores of this lake indicate every appearance of its having been much higher at no distant date, probably before the river Santa Cruz, which carries off the surplus water, had cut the deep channel it now occupies. The edge of the bay was strewn with erratic boulders deeply

scored by ice. These must have been comparatively recently transported from the glaciers of the cordilleras by icebergs and stranded on the shore.

The next march took us to the east end of the lake, where we crossed the Santa Cruz about a mile below where it leaves the lake. The current is very strong, running 7 miles an hour. Though there is plenty of water in this river, its strong stream will always debar it from being used for purposes of navigation, otherwise it would have made a splendid highway to the Atlantic.

Immediately on crossing the river we caught some armadillos. This animal is not found south of the Santa Cruz, but it is very common to the north. It is a good example of the spread of animal life being arrested by a natural feature.

The next march took us up the valley of the Rio Leona, which flows from Lake Viedma into Lake Argentino; thus the Santa Cruz carries off the drainage of these two lakes. Another march brought us to the shores of Lake Viedma. We had a splendid view, which is somewhat rare, of the whole range of the cordillera, including Mount Fitz Roy, the highest peak in this district. Its height is about 11,000 feet. Towards the top it appears to be too steep to hold snow, and looks quite bare.

An enormous glacier descends to the water's edge at the west end of the lake. It emanates from two mountains, one north and one south, in the line of the cordilleras, which are joined by a comparatively low saddle. On to this saddle the glacier descends. Tradition says it here divides in two branches, one going to Lake Viedma and the other reaching the Pacific, somewhere near Eyre sound. It is, however, unexplored, but from appearances this might be the case. If it really happens, the continental water-divide, and consequently the boundary between Chile and Argentine, would follow the surface of an ever-moving glacier. From this might result serious embarrassment where already complicated boundary questions exist.

Passing round the east end of Viedma, we crossed a low range into the valley of Lake San Martin. This lake, unlike Viedma and Argentina, has an exit into the Pacific. At the east end of the valley there is a small shallow lake called Laguna Tar. At present its waters flow into Lake San Martin, *i.e.* in a westerly direction. The continental water-divide is here so ill defined that a cutting of a few feet would cause Laguna Tar to flow to the Atlantic. There is the dry bed of a stream visible, and in time of flood this lake may, temporarily, have an exit in both directions. The continental water-divide would then run through a lake. A water-divide, therefore, without precise knowledge, may prove a very inexact definition for a boundary.

San Martin undoubtedly occupies what was once a strait joining the Atlantic and Pacific. The main body of water runs almost east and west, penetrating into the heart of the cordillera. The mountains rise abruptly from its shores. It is subject to the most violent

FIG. 14.—PATAGONIAN SCENE.

FIG. 15.—WAVES BREAKING ON SHORE OF LAKE VIEDMA.

FIG. 16.—MOUNT KOCHAIK VALLEY OF LAKE SAN MARTIN.

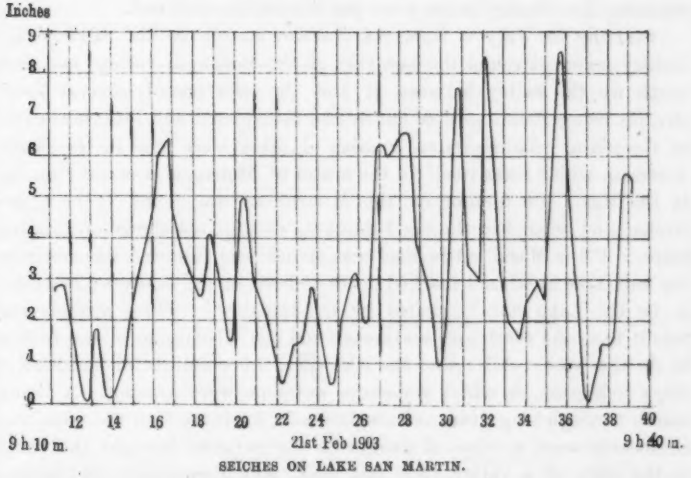
FIG. 17.—BAHIA DEL DEPOSITO.

FIG. 18.—BASALT CLIFFS, CANAL CHACABUCO.

FIG. 19.—VIEW ON LAKE SAN MARTIN.

storms, which make the lake very rough and dangerous to navigate, as I have reason to know after a week's expedition on it in a canvas boat.

While encamped on the shores of a sheltered bay, I noticed that the level of the water rose and fell in a peculiar manner. More exact measurements showed that the movements were irregular, but on an average amounted to about 5 inches, having a period of about four minutes between two successive high waters. The surface of the water to the eye was perfectly smooth. I append a diagram of these "seiches," showing 30-second observations extending over half an hour.



SEICHES ON LAKE SAN MARTIN.

The rocks round San Martin are mostly basalt. In many instances it is cellular, indicating that it had flowed under water. The geological sequence of events here would seem to have been somewhat as follows: A submerged land, when the sites of the great lakes were arms of the sea such as we now find in Tierra del Fuego; volcanic activity, when lava flowed under water, as shown by the existing cellular basalt; elevation of the land, for we find numerous instances of upraised beaches with cellular basalt overlying them; following this another period of volcanic action, and then an age of ice, for there is very marked evidence of ice-action on the basalt. In the present glaciers we have the lineal descendants of a glacial period.

In conclusion, I should like to point out that Patagonia is an excellent field for the traveller who wishes to explore unknown glaciers, and to study glacial action. It is full of interest to the geologist. The climate in summer, though cool, is extremely healthy.

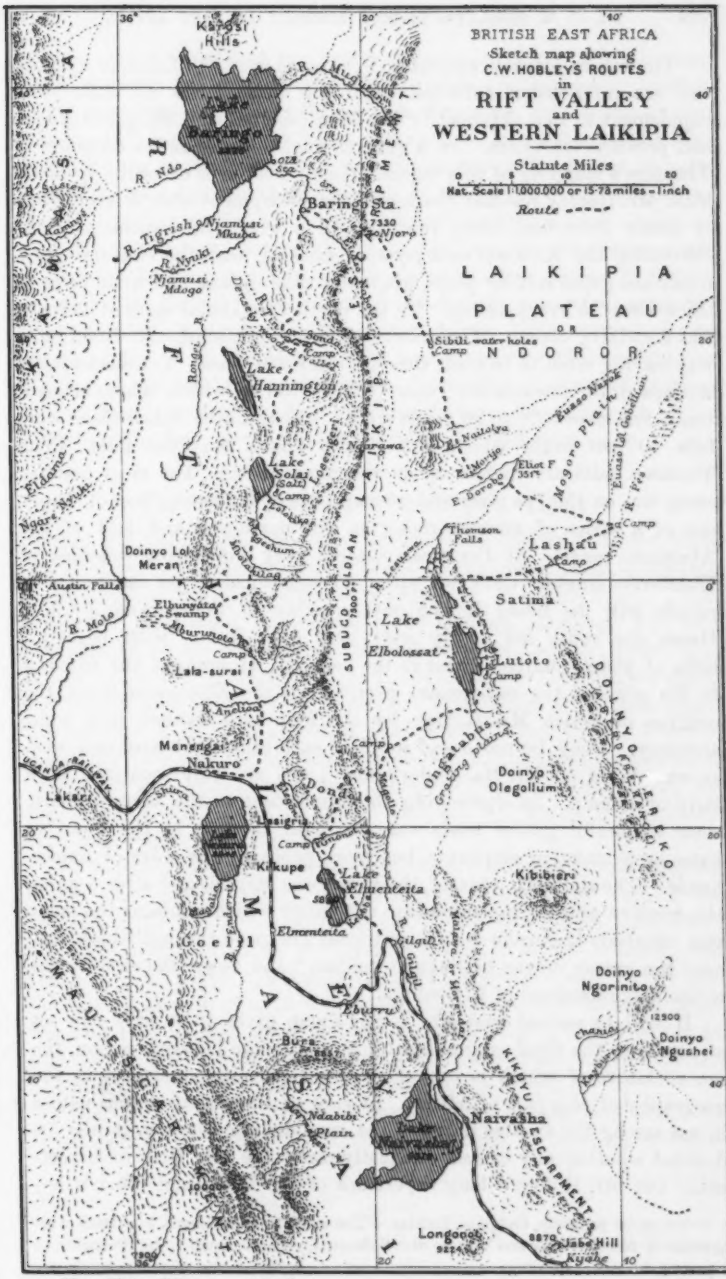
A map illustrating this journey appeared in the February (1904) number of the *Geographical Journal*, vol. 23, No. 2.

MR. C. W. HOBLEY'S RECENT JOURNEY IN EAST AFRICA.

We have been favoured by the Foreign Office with a report, by Mr. C. W. Hobley, on a journey made by him in 1904 in the rift-valley between Lakes Nakuro and Baringo and on the Laikipia uplands to the east. It is accompanied by a sketch-map (of which the accompanying small map is a reduction), drawn by Mr. Hobley to show his routes and the main features of the country traversed. The districts passed through are still far from well known, and Mr. Hobley's narrative adds many details to those supplied by previous travellers, though, as he himself remarks, the country is not even yet thoroughly explored.

Starting on July 6 from the Nakuro station on the railway, Mr. Hobley marched round the east side of the Menengai volcano and then north up the valley between it and the escarpment, several small streams being found to flow out of the escarpment and lose themselves in the plain. An enormous number of zebra were seen in the latter. A stream which loses itself in the crater of Menengai was not running at the time, but further on the Mburunoto was found to be a fine stream, and to end in the big Elbunyata swamp, not shown on existing maps. A fine Masai cattle road was struck and followed due north to the salt lake Solai, not marked on the official map. It seems, however, to be the Lake Kibibi visited by Dr. Gregory.* Three streams run into it from the south and south-east, and the Mbolakilag is said to flow in on the west. All round the lake there were delightful meadows of thick rich grass, on which numerous antelope were grazing. A tiring march through long grass and acacia woods, during which the numerous rhinoceros were a cause of danger to the caravan, brought the party to the edge of a valley 1500 feet deep, which separated the plateau over which they had been travelling from the Laikipia escarpment, here rising abruptly 3000 to 4000 feet in colossal buttresses and cliffs. Descending by a very rocky path, they found at the bottom a delightful river, 20 to 30 yards wide, called Tin by the Masai and Sondai by the Njamusi. For a time the march was continued over very broken country within the valley, along which some dense acacia forest was seen; but on seeing a large herd of elephants climbing the escarpment in a north-westerly direction, it was decided to follow their example, and after a climb of 1200 feet a broad valley was reached, with the main Laikipia escarpment on the right. A march of 16 miles due north over a waterless country then brought the caravan to the Baringo station, where Mr. Hobley spent two days, having several interviews with the Suk and Njamusi chiefs. The former people call themselves Pokot, Suk being the name given to them by the Masai.

* It is shown as Solai in Captain G. E. Smith's map in the *Journal* for September, 1899.


BRITISH EAST AFRICA
Sketch map showing
C.W. HOBLEY'S ROUTES
in
RIFT VALLEY
and
WESTERN LAIKIPIA
Statute Miles
Nat. Scale 1:1,000,000 or 15·78 miles = 1 inch
Route
LAIKIPIA
PLATEAU
Baringo
Lake Hannington
Lake Nakuru
Lake Elmenteita
Naivasha
Satima
Lutoto
Lashaku
Kikuyu Escarpment
Mau Escarpment
Doinyo Ngorinito
Doinyo Ngushei
Doinyo Olegolium
Kibibieri
Longonot
Lake Hill
Kiyuke
Thomson Falls
Austin Falls
Nakuro
Lakeside
Kikupe
Bura
Ndabibi Plain
Eburru
Elmenteita
Mbaruk
Lasa-sursi
Doinyo Lol Meran
Elbunyata Swamp
Elbolosset
Sibuli water holes
Camp
Njoro
Mjamusi Mbuga
Mjamusi Mtoto
Kamasia Hills
R. Molo
R. Tigrish
R. Nde
R. Susen
R. Kamasia
R. Njoro
R. Rongai
R. Lessos
R. Makalia
R. Subugo
R. Ndarugu
R. Gilgil
R. Kedong
Uganda Railway
Mau Escarpment
Kikuyu Escarpment
Subugo Lolgian Plateau
Mogoro Plain
Ndarugu Plateau
Kedong Valley
Gilgil Valley
Ol Gatabas Grazing plains
Ol Nutolya
E. Mariba
E. Barake
Eliot F 3515
Eliot Camp
Lessos
Kapkuna
Kapkuna Camp
Kabarnet
Kabarnet Hills
Sandai Camp
Sandai Valley
Lessos Camp
Lessos Valley
Kapkuna Valley
Kapkuna Hills
Kapkuna Camp

The return journey was made by a route over the Laikipia uplands, and the information collected regarding these forms an interesting supplement to that obtained by Mr. Tate (*Journal*, vol. 23, p. 220 *et seq.*) and previous travellers. In a general way, it confirms the accuracy of Thomson's mapping of this region. Going west over exceedingly stony hills, Mr. Hobley reached the top of the escarpment after a steep climb of nearly 3000 feet, being rewarded by a wonderful panorama of the rift-valley and Kamasia escarpment. Looking east, the country was a boundless green rolling plain, gradually sloping east, and with belts of thick forest in every valley. To the north the tabular mass of Loroghi was a striking object. The march led in a south-south-east direction, a way having often to be made through thick wet grass. Various swampy streams drain towards the Euaso (Guaso) Narok, which, where crossed, was a fine stream 20 to 30 yards wide. About a mile below there were falls 40 feet high, which Mr. Hobley names the Eliot falls. (The Thomson falls are higher up on the same river.) The most easterly camp was on the Pes river and swamp (Bes of Thomson, Pesi of Tate), one of a series of streams rising on the north-east and east of the Aberdare range. At Pes swamp some very interesting colonies of Wandorobo hunters were met with: a communication on these curious people will be found in the next number of the periodical *Man*. Hence the route led nearly west over open downs with beautiful belts of young juniper forest in the valleys. It brought the caravan to the edge of the escarpment overlooking the Elbollossat lakes, the outlines of which Mr. Hobley for the first time defined with some accuracy. They lie north and south of each other (not east and west as was shown on Mr. Mackinder's map), and are only separated by a strip of swamp. In descending the escarpment to the eastern shore, some wonderful graded roads were met with, thought by the Masai to have been made by elephants, but more probably the work of human hands. The southern edge of the water was skirted, and after 6 miles the western side of the miniature rift-valley which contains the lakes was climbed, the route being continued (in part through thick fog) over the grassy downs of Subugo Loldian* and down the escarpment to the neighbourhood of Elmenteita.

It will be noticed that Mr. Hobley's map gives an entirely new set of names to the chief orographical features of the Laikipia region, the nomenclature of which is one of the most puzzling questions in the geography of this part of Africa. In view of the multitudinous names in use among the various tribes of the surrounding country, it may be doubted whether any one set can justly claim the sole title to correctness; but Mr. Hobley's long experience of the Masai and other tribes

* Or, more properly, Osupuko Lultian. The word Subugo means highlands with patches of forest. It occurs also in the Subugu La Poron, applied by Thomson to a part of the Aberdare range.

lends a special weight to the names assigned by him. The Aberdare range is named by him Doinyo (Donyo) Lereko, Satima being applied to the northern extremity only. The Kinangop of Thomson, von Höhnel, and Captain (now Lieut.-Colonel) G. E. Smith, called also Donyu Ronyu by the last named, and Nandarua by Mackinder, he calls Doinyo Ngushei,* a neighbouring peak to the north being marked as Doinyo Ngorinito. Mr. Hobley's Kibibieri is evidently the Gojito of Thomson, which was thought by Gregory to have no existence except as part of the Satima range. It is also the lesser Satima of Smith, and its height should therefore be 11,174 feet, in accordance with the observations of that officer (*Journal*, vol. 14, p. 289), instead of the 13,390 of Col. J. R. L. Macdonald's map issued by the Intelligence Division of the War Office, this being the height of the main Satima in the Aberdare range. Mr. Hobley's Doinyo Olegollum,† a little further north, does not seem to be represented in previous maps.

THE EXPEDITION TO WESTERN TIBET.

INFORMATION has reached the Royal Geographical Society as to the main results of the expedition which Sir Frank Younghusband sent westwards to establish a trading centre at Gartok, in Western Tibet. This expedition was under the command of Captain Rawling, who was accompanied by the able and experienced surveyor, Captain Ryder, R.E., as also by Captain H. Wood, R.E., and Lieut. Bailey. Though the party had hardly any escort, it was received everywhere with open arms. The amount of new geographical work accomplished by this western expedition renders it of the first importance, and is some compensation for the stoppage of the expedition which was all ready to start down the Brahmaputra to solve the old Sanpo problem, but which, for some unexplained reason, was stopped.

Fortunately, during the progress of the expedition to Lhasa, Captain Ryder, who was in charge of the survey, was able to map all the country round the Khambajong camp. Fine views were obtained of the snows from Chumalari, past Kanchenjanga, to Mount Everest. One range running north, apparently from Mount Everest, and which, from the apparent height of some of its peaks, had excited interest in the camp, was found by triangulation to have no great height, 22,000 feet or so, and the two peaks north-west of camp, which one of the native explorers had mentioned, only proved to be 21,000 feet in height.

The Chumbi valley, which is narrow, did not take long to survey, but a portion of unexplored Bhutan was done by sending a native

* The altitude marked on our map belongs to this peak, and not to the Doinyo Ngorinito.

† Doinyo Olegollum is not a separate mountain, but is more in the nature of a bulge on the west face of the Aberdare range; it is shown in rather too pronounced a manner on the map.—C. W. H.

surveyor down the valley to the plains and back again. The mission then moved forward to Tuna, and later to Gyantse, the country around which was mapped. On the advance to Lhasa, in the Karoda, on either side some fine snow-peaks 23,000 feet or so, was seen a portion of the Yamdok Tso, the obvious old outlet of which was passed at Yarsik, but a small stream now flows in there, and not out of the lake. Military considerations prevented any surveying further than some 30 miles up the valley from Lhasa, but Captain Ryder and Captain Cowie made a good accurate map of Lhasa itself and its suburbs. The party under Captain Rawling had a most interesting journey westwards; they had two and a half months of continuous marching and surveying.

Briefly, the results of the journey, geographically, are that Captain Ryder and Captain Wood have surveyed the Brahmaputra from Shigatse to its source, the Sutlej from its source to British territory, and the Gartok branch of the Indus; they have also surveyed the Mansarowar and Rakas Tal lakes, proving that while there is an outflow from the former to the latter during four months of the year, during the rains and the melting of the snows, there is now no outlet from the Rakas Tal, although the Tibetans declare there used to be. This moves the sources of the Sutlej far west of what they have generally been considered to be. They also fixed many snow-peaks, and although the computations have not been worked out, it seems clear that no peak exists anywhere approaching Mount Everest in height.

CAPTAIN OWEN'S MAP OF UNYORO.*

By the courtesy of the Foreign Office, we are enabled to publish, in the present number, a sketch-map of the country between the Albert Nyanza on the west, and the Victoria Nile on the east and north, made during 1900–1901 by Captain R. C. R. Owen. It was compiled during tours of inspection carried out by Captain Owen whilst serving as Officer Commanding the Unyoro military district under the Foreign Office. The route-traverse was carried out with prismatic compass and cavalry sketching-board, distances being obtained by pacing, with the control supplied by intersection. The routes shown are those actually paced, but the country on either side was frequently examined for some distance. No attempt has been made to introduce detail from other surveys, or to adjust the work so as to fit it with that of previous travellers, except in so far as the whole has been adjusted to one or two positions determined astronomically, especially those of the late Lieut.-Colonel Vandeleur, whose work still supplies the best general basis for the map of this region. The map was sent home by the Director of Intelligence in Egypt, through Lord Cromer, and it is stated that sickness and press of work are responsible for the delay in its completion.

* Map, p. 352.

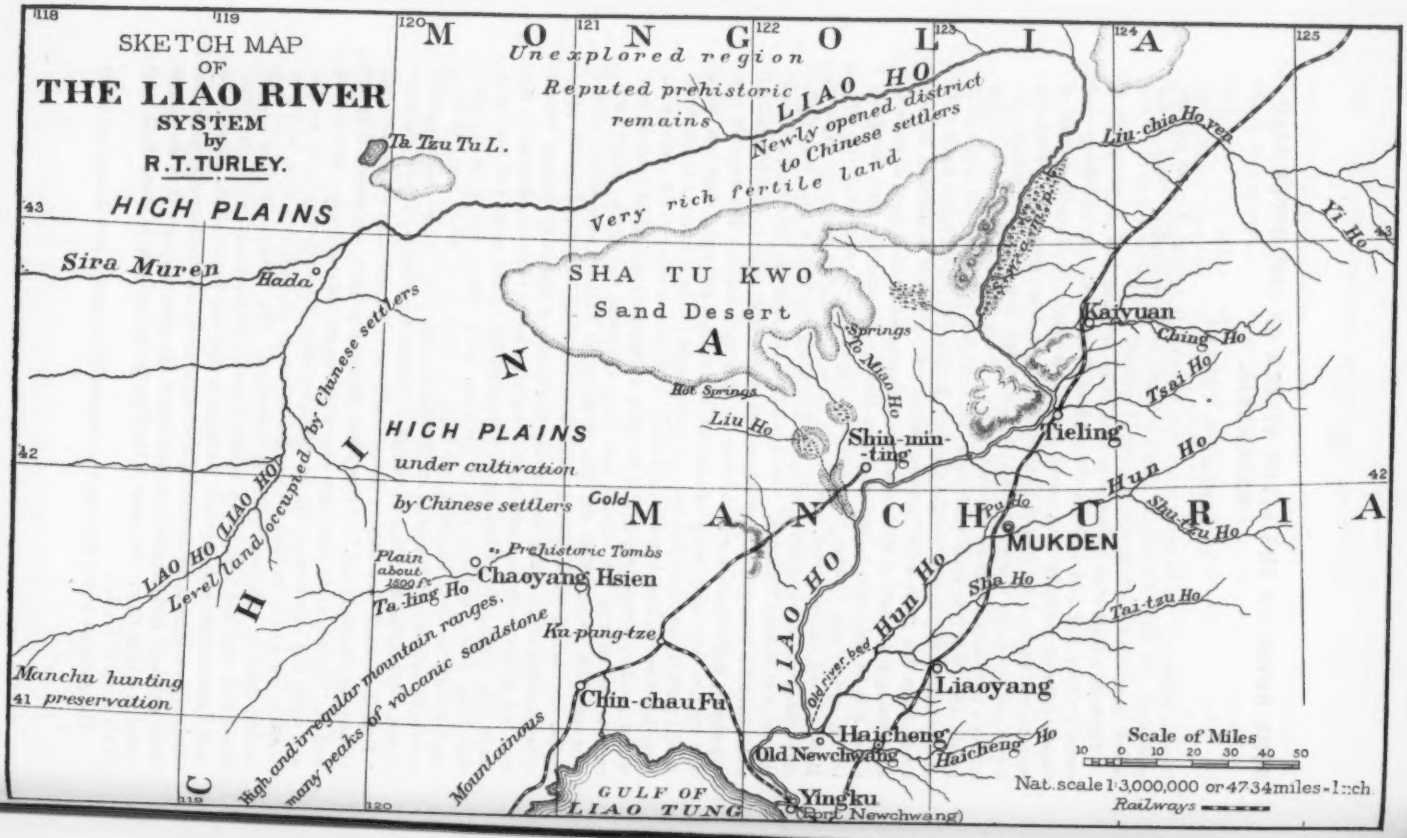
SOME NOTES ON THE RIVER SYSTEM OF THE UPPER LIAO, MANCHURIA.

By ROBERT T. TURLEY.

THOUGH Manchuria has for many years been expected to become of great political importance, but little of a definite nature is known of its geography. Thus, a few general remarks on the Liao river may be of interest.

The main stream rises far away in Mongolia—or rather in a section which is virtually China, and just near the old town of Jehol, north-east of Peking—and thence, running north by east, enters Manchuria nearly on the 44th parallel of latitude, westward of the city of Chang-chiin-Fu, or Kuau-cheng-tzu. Both the source and mouth are almost on the 41st parallel, and thus its course actually describes a peculiarly elongated horseshoe shape. From the mountains and hunting forests near Jehol it receives much water, which it loses, to a somewhat large extent, as it wends its way slowly over the plateau. It passes through a region which until recent years was given up to nomads, but now thousands of industrious Chinese are turning the desert or wilderness into rich corn-lands for a good distance on either side of the river. Until it enters Manchuria—near the once Mongolian trading centre, now Chinese town of Cheng Chia-Tun—it passes only one town, Hada, a noted barter-market. One would venture to suggest that some explorer, experienced in Central Asian geography, should, making Hada a base, investigate the whole of Eastern Mongolia. Our knowledge is vague and uncertain, and such as we have has been gained from casual wanderers—often with but little practical experience, and mutually contradictory on important points. For example, one will describe mountains in a given district, and another will report only low hills. It will probably be found that both are partly right; thus, a traveller by rail from Shan-hai-Kwan to Newchwang would speak of mountains rising to the northwards, whilst another, journeying on the far side, across the high-altitude plains, will refer to the same as low hills, as seen from a distance and looking southwards. The same with rivers. East and west of the upper Liao are some curious phenomena. At certain places, rivers, quite wide and deep, are found in the early autumn which in the spring can scarcely be traced over the sandy wastes. Others may flow continuously to a certain point and then become extinct, absorbed in the sandy soil. Once, when travelling with a companion on the borders of the lesser Mongolian desert, which is east of the Liao, being winter, and a certain river unexpectedly in view, all frozen, we began to argue as to where it might flow, whether east or west; finally an old Mongolian came near, and we both appealed to him. He smiled knowingly, and said, "You are both wrong; it goes nowhere." "Explain yourself," we said. "It just runs a bit south, and then spreads out and is eaten by the sandy soil." "How about the rainy period?" we asked. "Then," said he, "further south there does arise from the ground much water, which flows as a sandy and treacherous river into the Liao below Hsin-min-ting." On another occasion we met a traveller who urged us not to advance, as a river, which we should reach at sundown, would be unfordable. We, however, pressed on, and found that what had been a deep current a few hours previously, which our friend, with great trouble, had only just managed to ford, was but a shallow stream. On further investigation, we discovered that some strong intermittent springs poured their waters at fairly regular intervals down this river-bed, and thus the natives called it a tidal river. Its name is the Ta-miao-ho, and can be found to the east of the town of Ku-Lor.

The geologist would find much to interest in the curious rock-formations of the


SKETCH MAP
OF
THE LIAO RIVER
SYSTEM
by
R.T. TURLEY.
MONGOLIA
Unexplored region
Reputed prehistoric remains
LIAO HO
Newly opened district to Chinese settlers
Very rich fertile land
Ta Tzu Tu L.
HIGH PLAINS
Sira Muren
Hada
SHA TU KWO
Sand Desert
Springs
Hot Springs
Liu Ho
Shi Miao Ho
HIGH PLAINS
under cultivation
by Chinese settlers
Gold
Level land occupied by Chinese settlers
LAO HO (LIAO HO)
Prehistoric Tombs
Plain about 1800 ft.
Chaoyang Hsien
Ta-ling Ho
High and irregular mountain ranges, many peaks of volcanic sandstone
Ka-pang-tze
Manchu hunting preservation
Mountainous
Chin-chau Fu
GULF OF LIAO TUNG
Yingku
(Port Newchwang)
Old Newchwang
Haicheng
Haicheng Ho
Liaoyang
LIAO HO
Old river bed
Hun Ho
Sha Ho
Tai-tzu Ho
MANCHURIA
MUKDEN
Shu-fan Ho
Hun Ho
Tieling
Shin-min-ting
Tsai Ho
Ching Ho
Kaiyuan
Liu-chia Ho
Yi Ho
Scale of Miles
10 0 10 20 30 40 50
Nat. scale 1:3,000,000 or 47.34 miles-1 inch
Railways

hills—where such occur—especially the various lava-beds laid bare here and there, and volcanic sandstone in which sea-shells and water-plants can be traced by their markings; and in many a watercourse pieces of fossil wood, white and glistening, may be picked up. Whether or not the archæologist would be rewarded, one can hardly say, but I am inclined to think that buried remains of a bygone race may be found. Near Chao Yang there were some curious cists and non-Mongolic tombs, and one has a theory that a highly civilized race, from whom conquering hordes gradually emerged and swept down towards Southern Asia and Europe, once peopled this region.

The Chinese colonist of Shantung and Chih-li, whose very instinct is to destroy all trees and brushwood, finds that, once the Mongols cease to burn the steppes and when these are brought under the plough, trees will flourish. A few feet beneath the surface of the soil much moisture exists, and so willows and cotton-wood branches are planted very deeply, and these, in a few years, become fine groves of trees, which modify the air and act as a break to the terrible winds, which in springtime would, otherwise, blow the seed-grain out of the ground. Owing to the wasteful habits of the nomads, the sandy deserts have rapidly encroached on once fertile lands.

The most northern bend of the Liao river, which is formed by the junction of the Lao Ho (Khe) and Sira-muren (or upper Liao), is fully 100 miles due north of the position allotted to it on most maps, which follow the error of the cursory survey of the famous Jesuit fathers in the reign of the Emperor Kang-hsi. About lat. 43° 50′ and long. 123° 40′ the river turns almost due south, and from this bend to the sea might be made navigable for the ordinary river traffic if taken in hand at least for a few months of each year. The Government allows, however, no boats to pass above the customs station at Tung-chiang-tzu, a large emporium 100 miles further south, and near the town of Tieling, which, as a military centre, controls the river.

The first tributary in Manchuria to bring any amount of water is the Liu-ho-Yen river, which drains a considerable area between Kaiyuan and Kwan-cheng-tzu, and which is bisected by the Russian railway. Then above Tieling, about 30 miles, there is the Ching Shui Ho, and just north of Tieling the Tsai Ho, both spanned by fine railway bridges, but generally fordable for ordinary traffic, excepting at or immediately after the summer rains. From Tieling to within 90 miles, in a direct line, from the sea at San-cha-Ho, where the Hun enters the Liao, there are but small streams. San-cha-Ho is the tidal limit, and from here to Newchwang the water is always more or less muddy, though clear above this point.

The Hun is navigable for small junks from Chang Tan, a place 30 miles below Mukden. In the vicinity of this city the Hun is wide and shallow, with sandy wastes and a shifting bed. Above Mukden it is used only for down-stream rafts. The scenery is grand above Mukden, and the Fu-shun valley is especially beautiful, the scenery commencing with the famous Manchu tomb-hills and forests of the Fu-ling, where No-ar-chu, grandfather of the first Manchu emperor, sleeps.

Thirty miles west of Liaoyang the Tai-Tzu joins the Hun at Hsiao-Pei-ho, and is navigable for shallow-draught boats only to Liaoyang city. Fifteen miles west of Liaoyang the Sha-ho enters the Tai-Tzu, and is an insignificant and sluggish stream which flows, from below the railway bridge of Sha-ho-pu, between high banks, very steep, and in a narrow and boggy bed. Above the bridge there is an open and deep sandy bed, with a, usually, small stream meandering over it.

The Liao has not a single bridge of any description, and is crossed on the ice in winter, or by ferries during the open season. In its remote upper reaches it is fordable. The fish are poor in quality, few species, and small in numbers, excepting the semi-salt water varieties near the port of Newchwang.

THE MAP.—The map has been compiled as follows: The sources of the Liao—or Lao Ho (Khe)—from inquiries made by myself when travelling in south-eastern Mongolia, especially from data supplied by the Rev. John Parker (London Missionary Society), who worked the whole region. Later I sent a fairly well-trained native to gather all the information he could, and I depended on him for the section from Hada to the northernmost point. The Sira Muren is inserted from Russian sources, which are not quite reliable. From the most northern point to the mouth the river has been, on the whole, carefully sketched by myself; a few main places were fixed for latitude and longitude, etc. (the latitude is the more correct), and other details from compass-bearings. I am very familiar with the whole of the river and its tributaries from the northernmost bend to the sea. I have been much about the Eastern desert and the curious disappearing rivers.

THE MAJOR NATURAL REGIONS: AN ESSAY IN SYSTEMATIC GEOGRAPHY.*

By A. J. HERBERTSON, M.A., Ph.D.

THOSE of us who teach geography in the Universities have constantly to answer the question, What is geography? and in preparing our work we have to be quite clear about its content and scope. In this country we are less tied by tradition than in some others, for there is practically no systematic geography to bind us. In Germany the Ritter and Humboldt traditions gave rise to two schools. To America the Ritter tradition was carried over by Guyot, but a new one developed by geologists has superseded it. For long in our country geographical progress meant exploration, mainly with a commercial or political bias, and descriptive and statistical geography was taught. It was only with the rise of an academic geography that the wider conception of geography as the science of distributions developed.

In studying distributions comparisons were inevitable between geology and orography, climate and vegetation, and so on, and we were led to think that there might exist definite natural divisions of our globe. This resulted in an attempt to replace the purely political divisions of the world by others based on configuration. At this stage both the teaching and text-books gave a rational analysis of the main-feature lines as a guide to the general build of the continents, and this was supplemented by a consideration of the climatic and biological elements also for the continents. In the detailed study of each continent, however, the descriptions were applied to the various political divisions. This is found to be unsatisfactory. Why should Southern Canada be treated separately from the Northern United States? Such separation involves much waste of time, which would be obviated by a more rational subdivision of North America.

How are we to go about making the more rational subdivisions? At the outset two difficulties present themselves: (1) What characteristics should be selected to distinguish one region from another? Size is not a sufficient guide, although it must not be neglected; neither is structure, nor even configuration, although this last suggests many important divisions of the Earth's surface, which must be taken into account in any rational classification. (2) How can we determine the different orders of natural regions? The British Isles, for instance, form part of

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* Research Department, February 29, 1904.

a much larger natural area, that of North-Western Europe, while they themselves can be analyzed into a number of sub-regions.

The recognition of geographical forms has gradually been taking place. It has necessarily been late in the history of thought, first, because our knowledge of the surface of the globe was insufficient until the explorations of the nineteenth century had traced its fundamental features; and, second, because the specialist interpretation of the accumulated data was a necessary preliminary to its utilization for systematic geography.

The evolutionary ideas of the latter part of the eighteenth century were applied to biological and human affairs in the nineteenth, and the fascinating work of examining natural objects in their light absorbed the energies of the best workers. All were forced to consider environment, and even its evolution. If Humboldt's *Cosmos* had no immediate successor, this was inevitable, as a period of intense analytical specialization was a necessary preliminary to the more complete synthesis, of which we now see the beginnings in all departments of thought. Speaking generally, this synthetic work must have been carried far enough to permit of at least rough mapping before the geographer can begin his part of the task. In Berghaus's 'Physical Atlas,' and for meteorology in Bartholomew's volume, we have the raw material for systematic geography as far as concerns the major forms. These maps, however, unless it be in the case of configuration, are not drawn from the geographical point of view, but from those of the various specialists who have edited the volumes.

In what way is the geographer to use this raw material in working out a systematic geography? This involves the question, what is the subject-matter of geography? This I take to be the study of phenomena from the point of view of their distribution on the surface of the Earth, in natural groups, and not as isolated phenomena.

Geography is not concerned with distribution of one element on the Earth's surface, but with all. If geographers first regard the distribution of different phenomena separately, it is only in order to help them later to consider them together more effectively. This is not to say that all these different distributions are of equal importance, but that all must be taken into consideration before the problem of systematic geography is solved. Some may bulk more largely in the geographical consciousness than others, but all must be kept in view. Configuration is necessarily the framework, but we must not think of it merely as a more or less irregular surface; we must see it as part of a solid which comprises not merely the soil beneath, but the air above, with relations to other parts of the Earth, and also to the influences coming from outside the Earth. This gives a movement, a life to the whole, and it seems to me useful and not altogether fanciful to speak of this geographically discerned complex as a macro-organism.

A recognition of more complex units than the individual has gradually taken place, and has grown more familiar in our own country in recent years with the rise of such studies as those of plant associations, or in practical life with the development of local self-government. One may not have the exact equivalent of the biological species and genera, but it is useful to remember the existence of these, which suggest different orders of geographical divisions.

The systematic botanist or geologist has no difficulty in defining the objects of his investigation, although he may have many about their classification. The systematic geographer has first to point out what he wishes to systematize. This I believe to be definite areas of the surface of the Earth considered as a whole, not the configuration alone, but the complex of land, water, air, plant, animal, and man, regarded in their special relationship as together constituting a definite

characteristic portion of the Earth's surface. The question is, what are the characteristic and distinguishing elements of the areas which we may term natural regions?

While we may not be able to dissect our natural region or terrestrial macro-organism into the organs, tissues, and cells of the vital organism, we can find in this idea a useful hint. We may see in such a paper as that by Prof. W. M. Davis on the "Drainage of Cuestas," the beginning of monographs on the tissues of the Earth's surface. These will deal, however, not merely with the mutual adjustments of drainage and land forms, but also with the well-marked zones of climate, vegetation, and even human distributions which characterize such forms when situated in similar climatic areas.

The recognition of the possibility of dividing the lands into great natural regions I have found so useful both in investigations and in teaching, that I venture to bring it before you. I think it should prove a stimulus to geography, similar to that derived from the development of a natural systematic botany or zoology. This paper does not profess to present a complete solution, which cannot be arrived at in the existing state of our knowledge, but is intended to initiate a discussion on—

(*a*) The desirability of developing such a systematic geography.

(*b*) The major units with which that systematic geography would deal.

It is essential, first of all, to pass in review the areas determined by the distribution of one or other class of phenomena, before discussing the natural regions which can be outlined from a consideration of the distribution of all classes. The facts of configuration and of climate are of first importance, but the distribution of vegetation, and even of man, may also profitably be examined.

Configuration.

Two facts have to be considered—first, extension horizontally and vertically; second, the surface form, which is determined by structure, the nature of the transforming processes, and the time during which they have been active.

It is hardly necessary to refer to the vertical distribution of land. The 600, 3000, and 6000 feet (or 200, 1000, and 2000 metre) lines are perhaps the most valuable. Special terms for those different zones of height would be useful, but are difficult to select from our ordinary vocabulary; lowland, upland, highland are the least unsatisfactory for the three lower zones. Perhaps, following Wagner, "culminating land" or else lofty or upper mountain zone might be used for regions over 6000 feet (or 2000 metres).

This culminating land, above the 6000-feet line, is almost confined to a Pacific belt bordering that ocean, to a Mid-World belt from the East Indies to Iberia, to Greenland, and to eastern Africa. The lowlands are found mainly on the continental side of the Pacific lofty belt, and on both sides, but more particularly on the Arctic side, of the Mid-World belt.

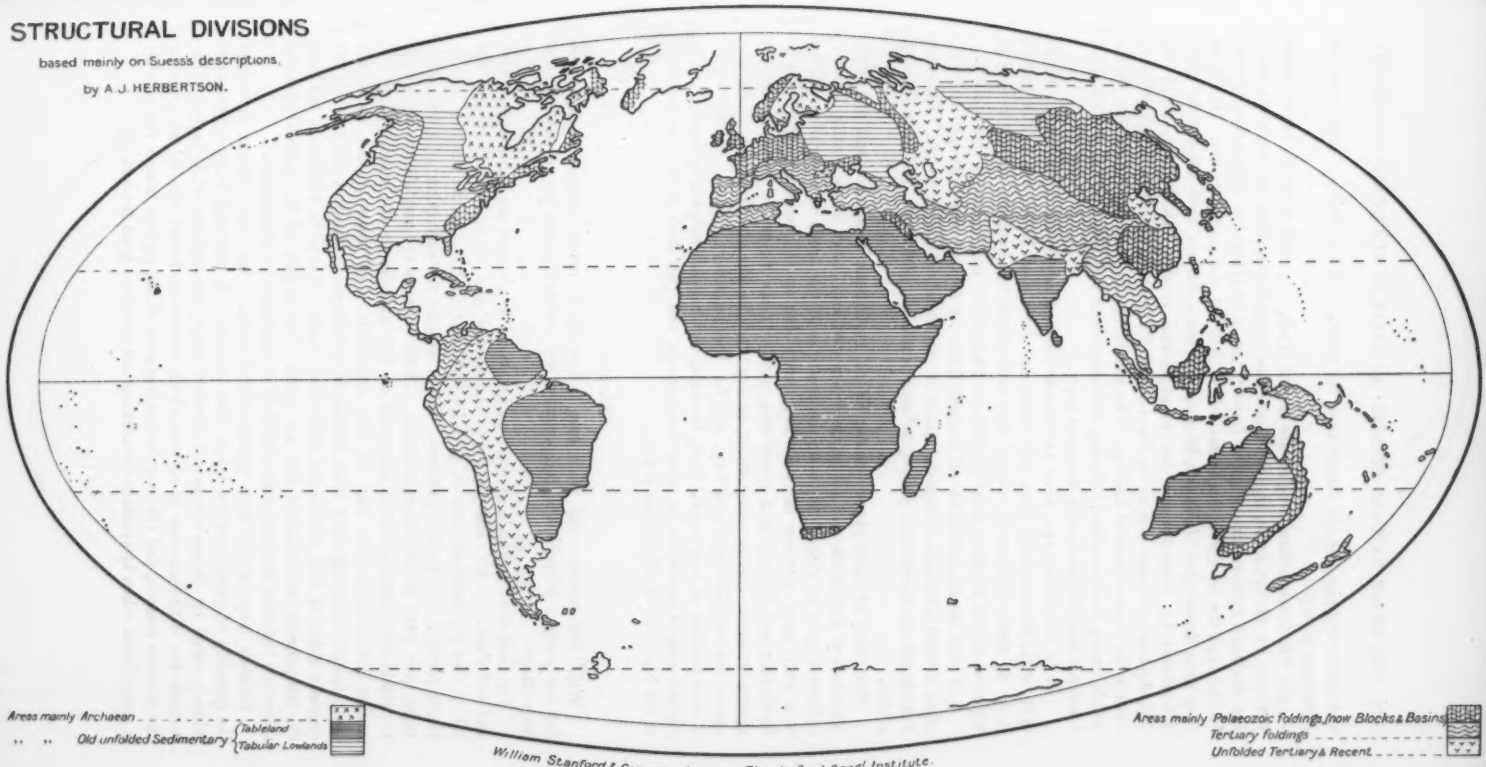
The feature lines of both the high and low lands are varied, and depend in the first place on the structure of the crust. The accompanying morphological map is based mainly on Suess's classical work.

(1) The Pacific and Mid-World belts of lofty land coincide with the areas where the rocks of *all* ages have been folded into parallel ridge and furrow—*the young folded mountains*. The continuity is modified here and there by great lava, flows and volcanic cones, or by raising or lowering of great blocks as a whole. The general features are all drawn out in the direction of the belts, which we might describe as the crests of major waves, of complex undulating character, bordered by

STRUCTURAL DIVISIONS

based mainly on Suess's descriptions.

by A. J. HERBERTSON.



Areas mainly Archaean

" " Old unfolded Sedimentary { Tableland / Tabular Lowlands

Areas mainly Palaeozoic foldings, now Blocks & Basins

Tertiary foldings

Unfolded Tertiary & Recent

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two major troughs, the one deeper than the other. *Cf.* the Chilean deeps and the Paraguay plains.

(2) The intermediate heights are of two types. In both there are raised blocks bordered by sunken areas, the chief margins being determined by fractures, while the drainage systems are of great importance in shaping the superficial features. In one type the palæozoic rocks are folded, but not the younger ones. These we may term *denudation highlands*, because the main feature lines other than those determined by fractures are due to superficial erosion, which may, as in the Appalachians, or may not, as in the Central European Highlands, bring out very clearly the lines of crustal folding. The parallelism of ridge and furrow is on the whole rarely well marked. Young volcanic rocks are found along the marginal fractures both in this and in the next type.

(3) In the other type, even the oldest sedimentary rocks lie almost horizontally, with flexures only here and there, and form vast *tablelands*. The feature lines of these tablelands, where not determined by fracture, are river-valleys, which as a rule are steep-sided gorges—at least in the early phase of denudation.

(4) The *lowlands* consist of reduced forms of types 2 and 3, and, in addition, areas covered with recent deposits either of terrestrial or marine origin. These we distinguish as *denudation plains, tabular plains or platforms, and accumulation plains.*

The study of these types—young folded mountains, tablelands and platforms, denudation highlands and plains, and elevated and lower accumulation lands—suffices to give an idea of the main feature-lines of the lands of the globe. There is a very large number of varieties, partly due to the relative importance of fracturing and folding in a given area, partly to the nature of the transforming agents at work—ice, running water, or dry air. To the distribution of these processes the rainfall map is a key, and for the secondary division of land forms, a superposition of the orographical, tectonic, and rainfall maps is necessary. The rainfall map is important in other connections, and this leads to the consideration of the distribution of climatic forms.

Climate.

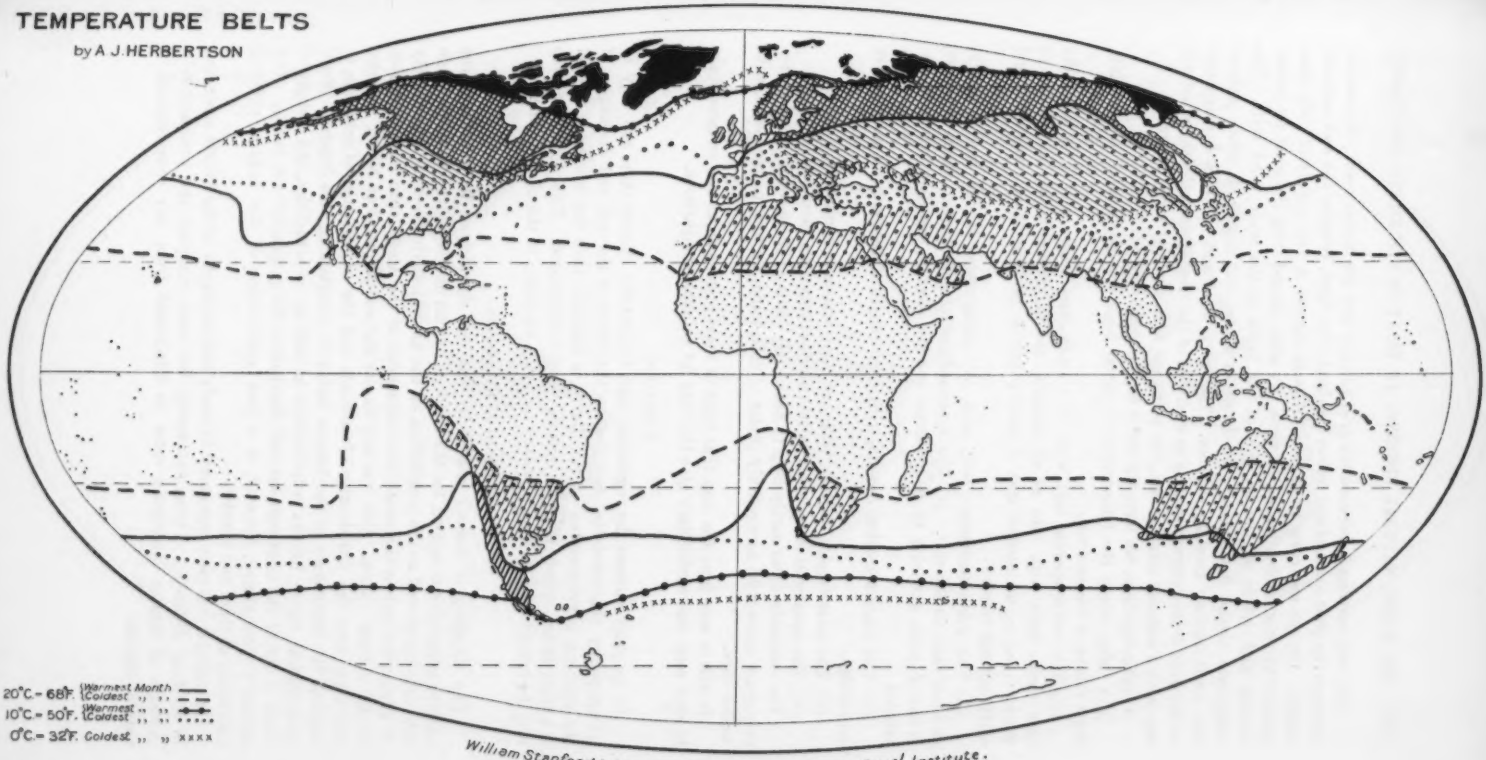
While the pressure and wind map is the key to many climatic peculiarities, for our present purpose the temperature and rainfall maps are of the greatest importance.

The isotherms available of most geographical importance are those of 32°, 50°, and 68° Fahr. (0°, 10°, and 20° C.) in the coldest, and 50° and 68° Fahr. (10° and 20° C.) for the warmest months, that for 50° Fahr. (10° C.) in the warmest month being perhaps the most significant. They indicate the succession of temperature belts, each with its own characteristics. These belts, as the map shows, are, owing to winds and ocean currents, narrowest in low latitudes in the west, and in the higher latitudes in the east of the continents. In these narrow parts the temperature conditions vary most within unit horizontal distance, whereas on the opposite sides of the continents they vary least. There is a contrast between the temperature conditions of east and west. This is part of the general climatic difference between east and west, which is of fundamental importance.

Rainfall maps are of even greater significance. The rainy season, as well as the quantity of rain, must be taken into account. A new map showing seasonal rainfall, based on Supan's seasonal rainfall maps, accompanies this paper. This permits the differentiation of regions which receive sufficient rainfall at none or one or more seasons, and the comparison between those regions where the rainfall is precipitated when temperature conditions are most and least favourable.

TEMPERATURE BELTS

by A. J. HERBERTSON



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The first contrast is between the drier interior and the wetter coast; the second, between the drier lowland and wetter highland; the third, between the east and west coasts. On the east coast most coastal lands receive a fair supply of rain from equator to polar circles, but in the west, dry areas extend from the coast far inland around each tropic on the lee side of the lands in the trade wind belts. The temperate coastal lands receive most rain in winter, but nearly all other parts of the world receive most in summer. The northward and southward movement of the wind-belts determines areas on each side of the tropical deserts—the equatorial one with a summer rainy season, the polar one with a winter rainy season.

Combining these, we have the following climatic regions:—

(1) Polar, where the temperature is never high and the rainfall always low, most falling in the summer.

(2) The cool temperate belt, with (*a*) a rainy west coast; and (*b*) a less rainy east coast—both with rain at all seasons, the maximum falling in autumn or winter; and (*c*) an internal area of great extremes of temperature, and a low and early summer rainfall.

(3) The warm temperate belt, with (*a*) winter rains in the west; and (*b*) summer rains in the east. (*c*) The intermediate internal region, where it occurs, is one of great extremes of temperature and low rainfall, especially where mountainous.

(4) The western tropical deserts, with great ranges of temperature, and little or no rainfall.

(5) The inter-tropical regions, with one rainy season in summer.

(6) The equatorial rainy areas, with two relatively drier periods.

The mountain areas partly help to define the limits of these regions, and partly introduce zones with successively colder climates and, up to a certain level, with wetter ones.

It will be seen from the map that most of these regions occur two or three times in each zone, and accordingly give the data for valuable comparisons.

Vegetation.

In its main outlines the vegetation map follows the climate map, and only in its secondary characteristics does it show the effects of the soil and drainage. If the existing plant-covering of the Earth is mapped, then the influence of man is a third factor, which in most botanic maps is eliminated. The vegetation map may be looked upon as a commentary on and a summary of the climatic ones.

Density of Population.

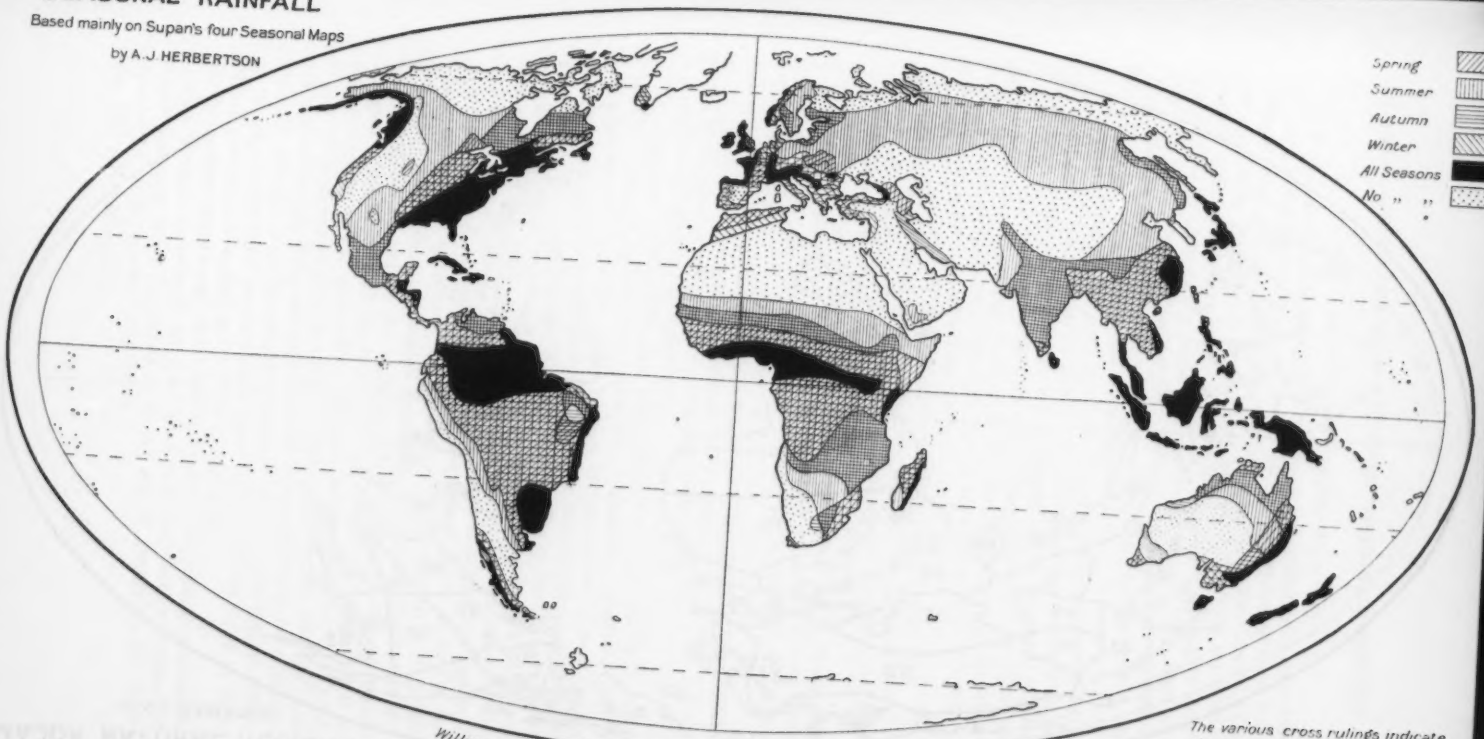
The mapping of human conditions has less significance in indicating the natural geographical regions, for the factor of human development has to be taken into account as well as the possibilities of the natural environment. The density of population map is the most direct expression of the actual economic utilization of the natural region. One has only to cite the central plains of North America before and after the introduction of railroads and the exploitation of minerals, to measure the importance of the human factor in determining this density. Each geographical region has its potentialities as well as its actualities, and a study of these is one of the most complex and fascinating the geographer can tackle. The necessary preliminary, however, is a just appreciation of the natural physical conditions of relief and climate.

Hitherto it has been customary to study the geography of the World according to political divisions. These, expressing the most complex and comparatively unstable of human conditions, must be eliminated from any consideration of natural regions.

SEASONAL RAINFALL

Based mainly on Supan's four Seasonal Maps

by A. J. HERBERTSON



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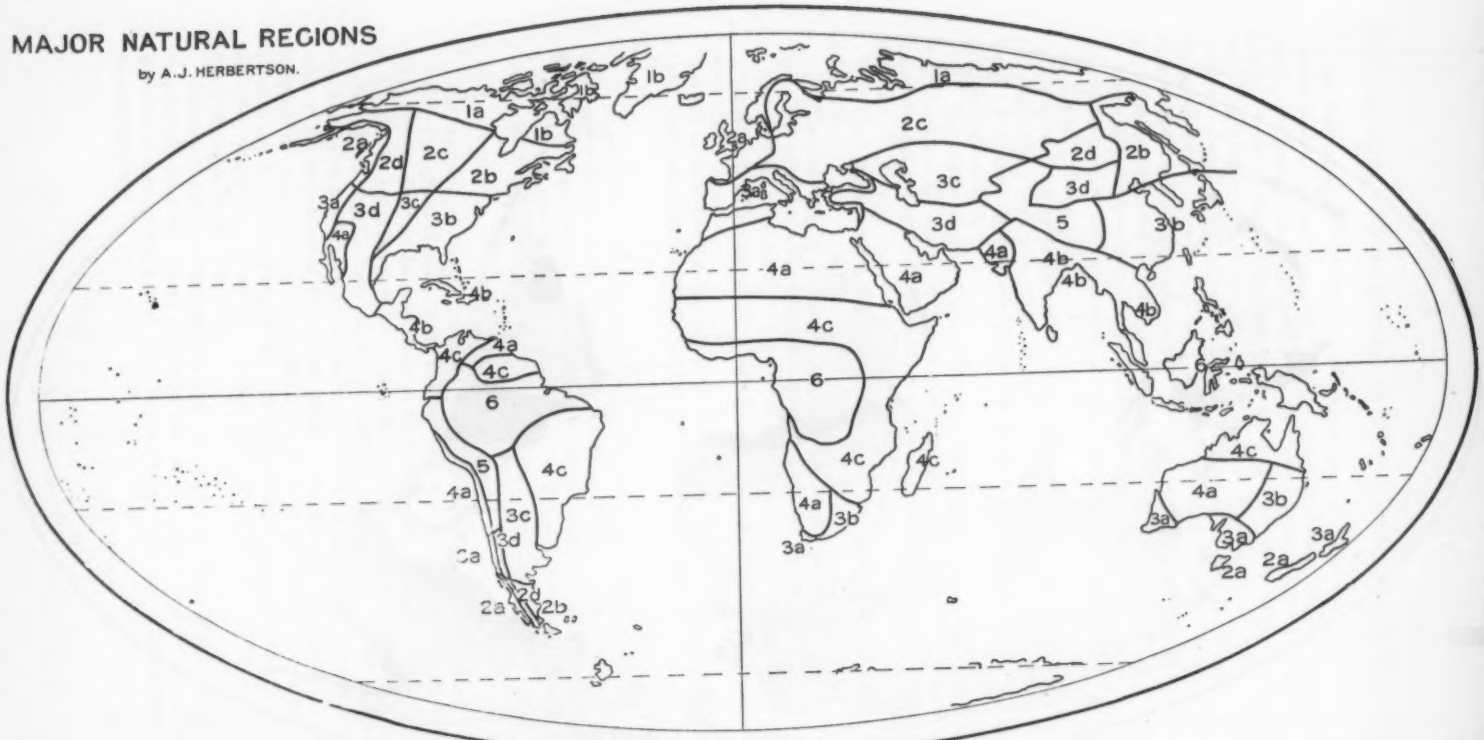
The various cross rulings indicate the Seasons which have more than 6 inches of Rainfall

MAJOR NATURAL REGIONS

by A. J. HERBERTSON.



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Natural Geographical Regions.

In the determination of natural regions, climate and configuration must both be considered. Climate, because it not merely affects the physical features, but also because it best summarizes the various influences acting on the surface. Climate even more than configuration, for the great barriers of the lands are climatic—wastes of arid desert or ice mountains—for it is the climate more than the configuration which renders lofty mountains effective barriers. Only when minor forms are taken into consideration does configuration become the all-important factor. On the accompanying map I have ventured to outline the regions which the consideration of all factors seems to me to determine.

A natural region should have a certain unity of configuration, climate, and vegetation. The ideal boundaries are the dissociating ocean, the severing mass of mountains, or the inhospitable deserts. As a rule, save in the case of the shore, the boundary is not at all well marked, but the characteristics of one region melt gradually into those of another. Premising that the lines on the map are taken as the approximate central lines of the transition areas, we may divide the world up into the following types of natural regions:—

1. Polar. (*a*) Lowlands (Tundra type); (*b*) Highlands (Ice-cap type).
2. The cool temperate regions. (*a*) Western margin (West European type); (*b*) Eastern margin (Quebec type); (*c*) Interior lowlands (Siberian type); (*d*) Interior mountain area (Altai type).
3. The warm temperate regions. (*a*) Western margin with winter rains (Mediterranean type); (*b*) The eastern margin with summer rains (China type); (*c*) The interior lowlands (Turan type); (*d*) and the plateau (Iran type).
4. (*a*) The west tropical deserts (Sahara type); (*b*) East tropical lands (Monsoon type); (*c*) Inter-tropical tablelands (Sudan type).
5. Lofty tropical or sub-tropical mountains (Tibetan type).
6. Equatorial lowlands (Amazon type).

The importance of regarding the Earth in this way can hardly be overestimated. Take, for instance, the application to education. Knowing each of the chief types, it is a simple matter to learn the peculiarities of each variety, and a great saving of time is effected, while the intellectual discipline of distinguishing the species and comparing the varieties is great. The application to economic and political affairs is even more obvious. Speaking generally, the permanent elements of each region are similar, and the history of the exploitation of the variety of any type of region where human development is most advanced should be of great profit to those interested in the exploitation or administration of the relatively undeveloped varieties of the same type. The recognition of natural regions gives the historian a geographical foundation for his investigations into the development of human society, such as he has not hitherto consciously possessed. By comparing the histories of the same race in two different regions, or of a succession of races in the same region, it should be possible to arrive at some knowledge of the invariable effect of a type of environment on its inhabitants, and permit some estimation of the non-environmental factors in human development. It would be difficult to exaggerate the importance of this investigation, which seems to me a fundamental one for all who have to deal with the study of man, or with his economic exploitation or his proper government.

No one is better aware than I of the incompleteness of the present communication, but I venture to make it in the hope that it may start criticism, and ultimately lead to a better understanding of one part of geography, and of its practical as well as its theoretical importance.

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In future papers I propose to deal in some detail with each type of natural region and its varieties.

After the reading of the paper, the following discussion took place:—

Dr. MILL: I am much interested in this attempt of Mr. Herbertson's to introduce something more systematic into the classification of natural regions, but I have hardly given the subject sufficient attention to justify me in opening the discussion upon it. My own views on systematic geography I have already elaborated and set forth to the best of my ability in my address to the British Association in 1901. I should like to ask Mr. Herbertson for what purposes he proposes to use those natural regions? Are they to take the place of the old division of the world into continents, or are they to be used for such discussions as are concerned with the distribution of climatic and botanical phenomena?

Dr. HERBERTSON: The continents would be as at present. This is a cross-division trying to consider all the factors, classifying the natural regions of each continent, by means of which we can connect one continent with another, such as Europe and Asia, or Africa and South America.

Dr. MILL: Understanding that, I am confronted with this very serious difficulty. Whatever one of the many distributions we consider, we shall find that if there is a classification possible with regard to it, it will in some respects run counter to the classification required for the consideration of other phenomena, and it is quite impossible, as I know from an attempt that was made, to get a classification of the world in natural regions that would satisfy the workers in several branches of science. The only classification equally suited for all purposes is that of coast-lines and degree-net. And my feeling is, the more general we can make the physical classification the better. I do not think we require to go beyond the purely orographical. It seems to me that the science of geography has to do essentially with the action and reaction of the configuration of the Earth upon the many mobile distributions, and that one classification or another classification may be appropriately adopted when we consider one or another of these conditions. But my feeling is that for the general purpose we should stick to the degree-net, the coast-line, and the contour-lines, which are necessary and sufficient. That appears to my mind to meet the contention that such a larger subdivision is necessary, and I fear that as our knowledge of climate advances, the lines dividing areas will be continually modified. I remember once trying to draw a map of Africa treating of the relative climates, taking into account all the conditions, altitude, latitude, prevailing winds, etc., and it was most difficult and very unsatisfactory. We must have more knowledge than we now possess before such a map could be drawn; ultimately it might be possible. But it is desirable that an attempt should be made to extend our knowledge and widen our grasp of the inter-relation of phenomena, and in that direction I think this paper of Mr. Herbertson's is extremely suggestive and most valuable, and I am quite sure that if it is further considered and published with the maps which have been exhibited, it will exercise a very considerable influence in promoting interest in geographical science.

Mr. DOUGLAS FRESHFIELD: Dr. Mill has already said all, or almost all, that I should care to say very much better than I could have said it. It seems to me that this attempt to create what I think Mr. Herbertson called in his paper genera in regions is a very difficult one. You will only get your genera by disregarding certain points in which regions differ. It may be an instructive inquiry, but I am rather doubtful as to its usefulness in teaching. I am afraid that as we grow more and more scientific we are liable to mix up geography with every

other science on the face of the Earth. And if we wish to promote geographical education we ought not to make it more complicated than we can help, though I fully recognize it must be complicated. Still, I hope we shall try and keep geography as far as possible to a definite field, and not intrude on geology or other sciences.

Mr. YULE OLDHAM drew attention to the difficulty of representing climatic regions cartographically, owing to the great difference between the horizontal and vertical temperature gradients, an elevation of 300 feet producing as great a change as is obtained by moving through a degree of latitude.

Mr. RAVENSTEIN: I have but little to add to what Dr. Mill has said. I think with him that the primary factor which determines geographical regions is elevation, and also the direction of the mountain ranges. There can be no question that the great plain of India, extending from the Ganges to the Indus, and bounded by the Himalayas and the Deccan, constitute one of these natural regions, and has its analogue in the great plain of Scotland. If you consider the effect which mountain ranges and plains have upon climate, the direction of the wind, the rainfall, and many other phenomena, you will find this is our only practical method. Comparisons such as have been made to-day by Mr. Herbertson are highly interesting and instructive, but I do think that for practical purposes they cannot act for us as guides, and they do not enable us to lay down geographical regions which would be universally accepted. I think, at the same time, that the term "region" ought in all cases to be applied in the way Mr. Herbertson does—that is, to portions of the Earth's surface which have something in common in their physical features and characteristics, and therefore "regional geography," I do think, is a very happy term to employ when we really mean chorography. Of course, chorography is not a word much used, whilst topography is; but I do think the department which invented that comprehensive word "catchment basin," might suggest a term equally acceptable for "Länderkunde," or chorography.

Dr. HERBERTSON: I do not think that the speakers have quite appreciated my difficulty. In trying to divide up the world into its major geographical units, relief is not a complete guide. For instance, in North America there are no very marked orographical features in the central plains, yet the difference between the parts round the Arctic ocean and the shores of the Gulf of Mexico is almost as great as that between the pole and the equator. Again, let us take the case of South Africa. The south-west corner, from the point of view of orography, and to a certain extent of structure, is practically the same as the south-eastern corner, but otherwise they are as far apart as Spain and China; for in the south-west, rains occurring in winter instead of in summer produce quite a different type of vegetation from that of the south-east with summer rains. You cannot read those differences from the orographical features. If this fundamental difference had been recognized in the war, it would have saved much. For teaching purposes it is desirable that we should find out what regions can be grouped together, so that by studying, say, fifteen or twenty types, the main features of the greater part of the world are learned, and merely the details of the varieties of each type have to be mastered later on. In practice this results in a saving of much time, and adds greatly to the value of geography as an intellectual exercise. Another reason why my classification takes more than orography into account, is the necessity for this in economic and political applications of geography. The historian has done comparatively little to elucidate the influence of geographical conditions on history, because the geographer has not yet put his material into a form which the historian can use. It has hitherto hardly been possible to eliminate the human factor by either comparing the sequence of historical events in a region of a particular character, or by

comparing the human history in different types of the same great species of region, and it seems to me from this point of view alone it is worth while trying to divide the world into natural regions.

Mr. MACKINDER: While I agree with Mr. Herbertson in most of his ideas, I hope that the expression "systematic geography" will not take root. This is an important point, and not one merely of words. Mr. Herbertson's real aim, as it appears to me, is to obtain a method for "Regional Geography," an expression which has, I think, taken root. I think that "systematic geography" is based on a wrong analogy. In "systematic botany" there are indefinite myriads of individuals in each species, but in the case of geography that would not be so; there are quite a limited number of natural regions, and therefore not more than a very few specimens in a species. The chief aim of Mr. Herbertson's paper is a valuable one, but it is not what his title suggests. He seeks, as I believe, the best compromise of criteria for determining the natural regions of the world—in other words, the "method" appropriate to regional geography. Systematic geography is not a self-evident expression, whereas regional geography is. Moreover, it is a rough equivalent for the German expression "Länderkunde."

Mr. RAVENSTEIN: No. Länderkunde is chorography.

Mr. MACKINDER: Chorography is not English; it is a heavy word that will never take root, and the nearest approach to it is regional geography. It appears to me a pity to confuse the public with a new term such as "systematic geography" when you mean no more than can be conveyed by the term which some of us have been labouring to establish in current use. We must take the balance of matters into account. One other point. I know that Mr. Herbertson will agree with me that for the purpose in view we must avoid the use of isotherms reduced to sea-level. They are absolutely useless for all purposes of this kind. What we require are isotherms as they actually determine the growth of vegetation on surfaces of varying elevation, and if you have such isotherms you will see they will sympathize with the contour-lines, and so give you clearer indications of the natural regions.

The CHAIRMAN: As the matter is one of purely technical education I fear I can offer no criticisms of any value whatever. I think Dr. Mill has expressed the general feeling of the meeting on the paper. For my own part, I thoroughly agree that the foundation of geographical education should be orographical, and that other subsequent considerations should be based upon that. To judge from my own experience, I should say that the varieties of nature are so infinite that I hardly conceive it possible to co-ordinate different parts of the world and to bring them under one head as a type of regional geography. Anyhow, Mr. Herbertson has introduced a subject of very great practical importance in geographical education, and I am sure I shall carry the meeting with me in thanking him very much for the address he has been good enough to give us.

REVIEWS.

EUROPE.

SWEDEN.

'Sweden. Its People and its Industry.' Published by order of the Swedish Government, and edited by Gustav Sundbärg. Stockholm: 1904. Pp. xi., 1142. *With Maps.*

THIS comprehensive work on the country and people of Sweden, forming a volume similar to that on Norway published by the Norwegian Government with

a similar purpose in 1900, appeared in that year in French, and was issued at the Paris Exhibition. The editor in his preface admits to unforeseen delay in the production of the present English edition, but has added an appendix giving certain supplementary facts to date, besides amending the text in certain places when necessary. The book is an admirable work of reference on every phase of Swedish life. The subjects of physical geography, with climate, flora, and fauna; history, demography, constitution, government, education, and social movements, and every branch of industry and commerce are dealt with by experts. Parts of the text lack the revision of an English hand (though its intelligibility at least has not been noticed to suffer), and a bibliography, even though mainly Swedish, might have been acceptable to some English readers; but apart from this the volume is beyond criticism. The configuration of the land is admirably presented by Dr. Gunnar Andersson. He divides his country into four physical regions. Upper Sweden includes all the main mountain chain of "the Keel" which falls within the kingdom, but extends thence to the Bothnian coast, and perhaps, therefore, might be more fitly termed the Norrland region, after the old territorial division with which it nearly coincides. The central lowlands continue southward to include the great lakes, Vener and Vetter; the Småland highlands lie south of these, and the fertile plains of Skåne (Scania), the richest agricultural district of Sweden, southernmost of all. The last is almost a land apart, but interesting parallels occur between the other divisions. Thus the Norrland region falls into three well-marked belts—the Alpine region of the high mountains; the middle belt of low hills and marshes, which, with its forest covering, has a very near counterpart in the so-called Småland highlands; and the coastal belt of recent marine deposits, which is actually a continuation of the central lowlands, as these deposits remain from the much-extended Baltic sea, which covered most of Finland and connected with the White sea. It may be noted that the extent of this sea, which has also left a debased marine fauna in the great central lakes, is excellently shown on a map.

Turning to the Alpine region, it would probably surprise few to learn that the extreme heights are as yet by no means fully explored from the scientific standpoint. The special locality, however, which Dr. Andersson indicates as little known is not, as might be expected, the line of heights from Kebnekaise, near Lake Torne, southward to Sulitelma, but those south of the headwaters of the Ume, in the vicinity of Rösvand, at the head of the Vojme and the Ångerman rivers, and southward towards the Jemtland highlands, where the Stockholm-Trondhjem railway crosses the pass of Storlien. Much interest attaches to the great lakes which lie on the eastern flank of the Keel in Norrland. Dr. Andersson points out that all occur between heights of 1000 and 1400 feet (roughly), and have many other features in common. He instances that their greatest depth is generally towards the western end (which, to judge from appearance, is the case), but corroborative details are not given. The work of glaciers upon the pre-glacial river-beds is generally assigned as the origin of these lakes, but "it is possible that an uneven upheaval of the land may have brought about changes in the watercourses." The remaining physiography of Sweden is too well known to need comment here, but each region is treated with clearness and precision.

The consideration of the industrial development and progress of the country occupies over one-half the volume. In this connection the main point of geographical interest lies in the iron-mines, which, along with her forests, are Sweden's richest economic possession. They fall into two groups—those in the region of the central lowlands, and the Arctic mines. Of the second the Iron mountain (Malmberget) near Gellivara has long been worked, but of far greater extent

are the deposits at Kirunavara and Luossavara, which the new northern railway, crossing the frontier by way of Lake Torne to Narvik, in Norway, has recently opened up. The foundation of smelting works near the Bothnian port of Luleå opens a new industrial field here (for hitherto the ore has been exported in a crude condition); and, considered in connection with the physical and climatic obstacles to be overcome, this seems likely to become one of the most remarkable industrial regions in the world.

Every possible subject, physical, ethnographical, and economical, is clearly illustrated on maps in this volume, and numerous photographs are reproduced.

O. J. R. H.

European Cartography.

'Skizze der Entwickelung und des Standes des Kartenwesens des ausserdeutschen Europa.' Von W. Stavenhagen. *Petermanns Mitteilungen*, Ergänzungsheft No. 148. *Price* 16*m*.

In this latest addition to Petermann's notable series of Ergänzungshefte, the author, Captain W. Stavenhagen, has rendered an immense service to all students and teachers of geography. One of the chief obstacles in the way of original geographical work has hitherto been the difficulty of ascertaining the scale, mode of production, and reliability of standard maps of different countries. This difficulty does not exist for the cartographical specialist, and it is perhaps not a serious one for the trained geographer; but, to take this country alone as an example, how many engineers know the different editions of the 1-inch Ordnance map and their merits, and how many school teachers, willing and able to use maps of different countries, can easily find any information beyond what is contained in a few short articles on "specimen sheets" in educational magazines? Captain Stavenhagen has produced a work of reference which removes the difficulty so far as the countries of Europe are concerned. Germany is not included in this volume, but is to have special treatment.

But besides a critical "bibliography of maps," Captain Stavenhagen gives a series of short but very adequate summaries of the history of map-making in each country, which places his book in a high position as a work of critical research, and give it a great value to the cartographers of all nations. The comparative study of different stages of map-development cannot fail to be of service to the authorities of all countries really awake to the paramount necessity of good maps for purposes both of peace and war, and it may, as Captain Stavenhagen hopes, pave the way for a system of international co-operation similar to the international Geodetic Commissions, which will include not merely the production of a map of the world on a scale of 1 : 1,000,000, but the adoption of uniform standard methods in the larger-scale maps.

An introductory chapter is followed by a historical review of the cartography of Europe as a whole. Ancient maps and maps of the middle ages are dismissed in two pages, and the modern period is divided in five sections—the Renaissance to the reform of cartography, the Reformation (Mercator, Ortelius, etc.), in the transition period (Blaeu, Moll), the period of triangulation and geodetic surveys, and modern cartography. Next follow the regions of Europe in detail: Central Europe includes Austria-Hungary and Switzerland; Western Europe, Great Britain and Ireland, the Netherlands, Belgium, Luxemburg, and France; Eastern Europe means Russia; in Northern Europe are Norway, Sweden, and Denmark; Southern Europe is subdivided into three, the Iberian, Apennine, and Balkan peninsulas.

It is, of course, impossible even to describe the contents of the different chapters. By way of an example, we may, perhaps, refer to the chapter on Great Britain and Ireland. The growth of British cartography up to the middle of the eighteenth

century is given in outline; then follows a short account of the beginnings of the Ordnance Survey. The progress of its work and establishment up to the present time are given in considerable detail, and a critical description of the maps as now published. The last section deals with maps issued by other authorities and by private firms. These include the Hydrographic Department of the Admiralty, the Geological Survey, the Post Office, and the Railway Clearing House, and such firms as Messrs. Bartholomew, W. & A. K. Johnston, Stanford, and others. The chief maps of the British Isles published abroad are also described. In the whole work we find abundant information, and, except for some misprints, such as the name of the first hydrographer on p. 95, substantial accuracy, while criticisms are fair and just, even generous.

ASIA.

The Trans-Siberian Railway.

'Le Trans-Sibérien.' Par A. N. de Koulomzine, Chargé d'Affaires du Comité du Trans-Sibérien, traduit du Russe par Jules Legras.' Paris: Hachette. 1904. Pp. viii., 326. *Price* 5*s.* 8*d.*

This work forms a companion volume to the 'Official Guide to the Great Siberian Railway' (1900), but it brings down the history of the great Asiatic trunk-line to the latest time, and includes a detailed account of the Manchurian—the so-called "East Chinese"—extensions. Among the excellent photographic illustrations of railway detail are views of the building of the cantilever bridge over the Ob (p. 84), of the rock-cutting in the construction of the Circum-Baikal section (p. 120), of the solitary tunnel on the line, that on the summit of the Yablonovoi hills with its inscriptions, *K' Velikomu Okeanu*, 'to the Pacific' (p. 132), and of the 5-furlong iron bridges over the Yenisei and the Sungari (pp. 142, 152). The subject-matter is divided under four heads, (1) "Histoire administrative," (2) "Construction," (3) "Colonisation," (4) "Résultats du Trans-Sibérien;" and a series of diagrams are appended, illustrating the movement of traffic (both passenger and goods) upon the Siberian system from 1897 to 1902, as well as the progress of emigration from 1882 to 1902. Finally, two maps of Siberia are appended, showing not only the railway and all its subsidiary schemes (the Pem-Kotlas, Samara-Orenburg, and other lines), but also the chief emigrant districts, the position of the principal known deposits of gold, silver, iron, coal, and copper, the lighthouses on the Baikal, and the meteorological stations along the whole of the trunk system. How far the railway was beginning to fulfil its commercial and civilizing functions up to the outbreak of the present war may be partly gathered from such facts as these. In 1898–9 less than 150,000 puds of grain were carried; in 1901 nearly 13,000,000 (though the *export* of cereals by the railway has diminished since 1898). Again, in 1890, the last year before the commencement of the "Trans-Siberian," 47,378 immigrants entered Siberia; in the next year (1891) the figure rose to 82,000, and has only once since fallen below that annual level (in 1893, when it was 61,000); while since 1895 it has regularly exceeded 100,000 (save in 1897, 86,000), rising in 1896, and 1898–1900, to 202,000, 206,000, 223,000, and 219,000 respectively.

C. R. B.

The Dutch in Java.

'The Policy and Administration of the Dutch in Java.' By Clive Day, Ph.D. Macmillan Company. 1904. Pp. xxi., 432. 8*s.* 6*d. net.*

This is a useful contribution to the literature of colonial administration. It is based very largely on Dutch sources, little known and inaccessible to the general reader, and in his preface Prof. Day points out that between the descriptions of

Dutch policy current in English, and the facts as they appear in the writings of Dutch historians, there is a wide divergence. The Dutch, in fact, have been severe critics of their own failures in attempting to administer Java. Holland was among the first of European nations to attempt the exploitation of a tropical land, and every step was necessarily experimental. The *régime* of the Dutch East India Company, which later added political power to its possession of a commercial monopoly, failed to gratify itself either morally or financially, and at the time of its dissolution in 1798, the debts of the company amounted to more than 134,000,000 gulden. After a few years of tentative and not very successful administration by the state, Java passed temporarily into the hands of Britain, and the well-known work of Raffles is associated with this brief period of British rule. The island was restored to the Dutch in 1816, who retained the land-taxes introduced by Raffles, though it was found almost impossible to put it on any fair workable basis. The system of forced cultures, an inheritance from the company days, which Raffles had found it inadvisable to abolish, though he disapproved of it in principle and discouraged it in practice, became a marked feature in the middle years of the nineteenth century. This part of the Dutch East Indian policy in Java is the one best known in this country, and it has been extravagantly praised by Money and others. Prof. Day criticizes Money as an ill-informed, inaccurate, and untrustworthy writer, but his influence in forming opinion in this country has been great. Prof. Day, writing as an economist, points out that the crux of the problem of tropical administration is the failure of the native as a consumer, and that till his basis of consumption is widened he will do as little productive labour as possible. The system of forced culture educated him in production, but did nothing for his education in consumption, while it intensified the original reluctance to labour, and tended in its working to be harsh, unfair, and oppressive. A Colonial Reform party strongly opposed its continuance, and a gradual transition to wage labour took place between 1870 and 1898, in which year the Government coffee culture, the last of the forced cultures, was abolished. The chapter on recent economic policy is a thoughtful analysis of the causes which make up the tropical labour problem, and in it the writer insists emphatically on the *rôle* of the Chinaman in Java "as the missionary of the modern economic organization." Prof. Day gives his authority for every statement of importance, a practice which cannot be sufficiently commended.

Palestine.

'Die Verkehrswege und Ansiedlungen Galiläas.' By Dr. V. Schwöbel. Leipzig: 1904. Pp. 152. *With a Map and Diagrams.*

Dr. Schwöbel has subjected to a very close investigation the parts of Palestine between the Sea of Galilee (Bahr Tabarie) and the Waters of Merom (Bahrat el-Hule), Tyre, and Acre. His object is to trace the connection between the distribution of population in townships, and villages, and the communication lines, with the natural conditions of the district. The divide between the Mediterranean slope and the Jordan depression lies close along the valley of the Jordan itself, so that the tributary valleys to the Jordan are few and mainly insignificant, and the longer slope is that falling seaward. The southern boundary of the district under notice is the railway, which, from the coast at Haifa, follows the valley of "the brook Kishon," in a south-easterly direction, crosses the low divide into that of the Jalud, and then runs north up the Jordan depression to the foot of the Sea of Galilee. The northern boundary is the Nahr-el-Kasimie, where that stream turns west to the sea north of Tyre, having previously (as Nahr-el-Litani) followed a

south-westerly on the east side of Mount Lebanon. Of this district Dr. Schwöbel provides a map of remarkable detail, indicating by different signs the populations of settlements, from 10 to 10,000 and upwards. Springs are shown, perennial and intermittent streams are distinguished, and such features as marshes are clearly marked. Unfortunately, it has not been found possible to indicate elevations. Of the caravan routes, that which runs close along the coast is connected with that following the same direction inland along the Jordan (which turns off, north of Galilee, towards Damascus) by a series of cross-routes, the general direction of which accords roughly with the natural lines of communication from west-north-west to east-south-east. The map also shows local tracks. The relief of the country is separately displayed in a beautiful series of sections. A diagram shows the divisions of the country according to the density of population. In the text, Dr. Schwöbel appends to his instruction a synopsis of the authorities (English, French, and German) for the district. He then deals in successive chapters with the physical characteristics of the land and the economic conditions of the people, before turning to the special question of their lines of communication and their distribution. His transliteration of place-names, avoiding the use of capital initials, and replete with accents and signs, renders the topography difficult to follow for readers unacquainted with the original forms of names.

AMERICA.

The Andes.

'La Cordillera de los Andes entre las Latitudes 30° 40′ i 35° S. Trabajos i Estudios de la segunda Sub-Comision Chilena de Limites con la Republica Arjentina.' Luis Patron S., Injeniero-jhefe. Santiago de Chile, 1903.

The Officina de Limites in Chile proposes to publish the most important data collected by the boundary commissions during the years 1894 to 1902; and this is the first volume issued. It contains the results of the work of the second sub-commission, which examined the country in the vicinity of the boundary from the Rio Mostazal southwards to the Rio Tinguiririca. Down to lat. 32° S. the Andes consist of three ridges frequently interrupted, of which the eastern is the highest. In the north, where it is called the cordillera de la Totora, it attains altitudes of over 16,400 feet. Between lat. 32° and 33° only the eastern chain exists, containing the heights of Mercedario (21,880 feet), and, in the south, the huge mass of Aconcagua. Four observations were made of the height of this summit, which Mr. FitzGerald gave as 23,080 feet, and the mean result was 22,830 feet. The interval from 33° to 33° 50′ is occupied by the great massives of the Juncal, the Polleras and Tupungato, where the lowest gap is that of Tupungato, 15,594 feet. South of 33° 30′ two cordilleras again appear, the western being here the more important and forming the continental watershed. From lat. 35° the watershed gradually becomes lower, its summits seldom reaching 13,000 feet, and the passes seldom exceeding 9800 feet. The rivers on the Chilian side are usually in the same line as those on the Argentine, and seem to be encroaching on the drainage basins of the latter. The commission extended a series of polygons along the boundary region, fixing many points astronomically and determining a number of heights. These geodetic results are recorded in the present publication, as well as observations of temperature and other meteorological phenomena, on glaciers, magnetic declination, which is marked by sudden variations, and other valuable information. The book is provided with maps, diagrams, and illustrations.

AUSTRALASIA AND PACIFIC ISLANDS.

Melanesia.

'Zwei Jahre unter den Kannibalen der Salomo-Inseln.' By Carl Ribbe. *Numerous Illustrations and three Maps.* Dresden: 1903. Pp. viii. + 352. *Price* 10*s.* 6*d.*

'Bilder aus der Südsee—Unter den Kannibalischen Stämmen des Bismarck-Archipels.' By Dr. Heinrich Schnee. 30 *Plates and Map.* Berlin: 1904. Pp. xiii. + 394. *Price* 14*s.*

Most naturalists are familiar with the name of Herr Ribbe, whose entomological, botanical, and ethnographic researches in Andalusia and Malaysia form the subject of numerous contributions to the transactions of the German Entomological Society, Dresden, and several other scientific periodicals. From Malaysia he extended the sphere of his investigations to New Guinea and Melanesia, where he spent altogether four years (1893–1896), devoting his attention more particularly to the northern section of the Solomon archipelago between about 6° and 9° S. lat. From his headquarters at the islet of Faisi, off the south coast of Alu (Shortland), several excursions were made to all the surrounding groups, which were carefully, one might almost say microscopically, studied in their manifold physiographical and biological aspects. Scarcely anything within the prescribed limits appears to have escaped the keen eye of this indefatigable observer, who here presents the grateful student with an all but complete picture of the fauna, flora, and ethnical relations in Rubiana (New Georgia), Ysabel, Choiseul, parts of Bougainville, and the "Shortlands archipelago." This expression, new to geography, the author proposes as a convenient comprehensive name for all the islets strewn over Bougainville strait, of which Shortland is the chief member, and which also comprised the important island of Fauro, known to us from Mr. Woodford's survey. This pioneer is briefly referred to now and then, but only one casual reference is made to Mr. Guppy, whose classical work on 'The Solomon Islands and their Natives' seems to be unknown to Herr Ribbe. He might else have dispensed with many details in his exhaustive account of these savages, whose daily life, weapons, domestic utensils, ornaments, tabu and totem systems, social and religious practices, scarecrows for driving away the circumambient demons, freemasonry, ailments, healing and cooking arts, industrial processes and languages, are all described with almost wearisome iteration. These treacherous and sanguinary head-hunting cannibals appear to have deteriorated rather than improved since their contact with the whites, and [despite their artistic skill in woodcarving and one or two other commendable qualities, the author finds no epithets too strong for these "von Natur lügnerisch, verräterisch, räuberish, hinterlistig, diebish, und grausam angelegten Kannibalen," both in the German and English sections of the archipelago.

Herr Ribbe finds all existing maps, even those of Gotha and the British Admiralty, often most misguiding, as in the Manning strait, where "had we trusted to these maps we should have found ourselves in the middle of the island of Ysabel!" It should, however, be stated that at this point the map of the Solomons in Dr. Guillemard's *Australasia* (Stanford Series) corresponds exactly with that specially prepared for Herr Ribbe's work, except that the Cape Comfort headland appears as a peninsula in the former, and in the latter as an island barely separated by an extremely narrow channel from the mainland. Besides this there are two other maps on a larger scale, a pretty full index, a profusion of excellent illustrations, botanical lists, comparative anthropometric tables, and a good deal of linguistic matter, including vocabularies of six local dialects and sixty-eight words in thirty-four Melanesian, New Guinea, and Malaysian languages. Many of these

are found neither in Wallace nor in Codrington, and they thus supply fresh material for the study of the Oceanic tongues.

In his compact, well-printed, finely illustrated, and clearly written volume, Dr. Schnee gives us the results of his experiences during an official residence of over two years (1898–1900) in the Bismarck archipelago (New Britain, New Ireland, Duke of York), and some of the neighbouring groups. Coming from a careful and unbiassed observer, the book is all the more welcome since hitherto very little accurate information was available on the geographical and ethnical relations of this northern section of the Melanesian world. Even after the German occupation of over twenty years, Dr. Schnee is obliged to admit that these insular groups are still amongst the least-known lands in the world, and although he himself crossed New Ireland from west to east, most of the interior of the large islands remains a *terra incognita*. His own investigations were made chiefly in connection with various punitive expeditions to nearly all the groups between the Admiralty (now called Manus) and the Solomon archipelago. Hence he has little to say about the inland tracts and the bushmen, who are the true aborigines, and often differ markedly from the "Kanakas," as the better-known coast tribes are now generally called.

The plan of the book is excellent. Instead of slavishly following a chronological order, which has but a passing interest, the author devotes a number of chapters to those subjects of permanent importance which are more or less common to all the groups and their inhabitants, and then fills in the details of those vivid "pictures from the South Sea" according as the opportunities present themselves during the numerous expeditions in which he took part. Thus, to give one instance, Mussau (St. Matthias), scarcely mentioned in the general chapters, is dealt with very fully in connection with the punitive expedition of 1899 to that group. It was found to consist, not of one island, as still figured on nearly all maps, but of quite a little cluster of islets and reefs, with one conspicuous member, inhabited by full-blood Papuan savages, speaking apparently a stock language, with a decided taste for weaving, but also for human flesh. Indeed, cannibalism, with all its associated horrors, such as the lingering death of the victims and the bartering of dead bodies with neighbouring "markets," is everywhere present to a far greater extent than had hitherto been suspected, a fact fully confirmed by official returns.

In the chapter dealing with the native languages, a most interesting account is given of the "pidgeon English," which has become the chief medium of intercourse in all the groups, not only between the whites and the aborigines, but often, as in China, between the natives themselves. Almost all the words are English, although sometimes corrupted beyond all recognition, and there is no grammatical structure to speak of. But Dr. Schnee is wrong in stating that the only pronouns are *me* and *you*, which with *all* are made to serve every purpose, even a dual, "a trial," and plural, both inclusive and exclusive in conformity with this striking feature of the Melanesian tongues. *He* and *him* are certainly also current, as in *master head belong him he big fellow too much* = "the master has a very large head." This specimen will serve to show that this strange Oceanic *lingua franca* has been developed on much the same lines as that of the Chinese seaboard.

At present the seat of the German administration, and the chief centre of trade, industry, plantation enterprise, and missionary zeal, is the fertile and relatively healthy Gazelle peninsula, which forms the northern extremity of Neu Pommern (New Britain). Here the soil and climate are distinctly favourable, and the prospects of plantation culture excellent, if the difficult labour question can once for all be satisfactorily settled.

The author's brother, Dr. Paul Schnee, contributes a valuable chapter on the indigenous flora and fauna, and this *vade mecum* of German Melanesia is provided with a copious index and a large-scale pocket map.

A. H. K.

PHYSICAL GEOGRAPHY.

The New Seismology: Two New Text-books.

'Handbuch der Erdbebenkunde.' Von August Sieberg. Pp. 362. Braunschweig: Friedrich Vieweg und Sohn. 1904. Price 7.50*m*.

'Earthquakes in the Light of the New Seismology.' By Clarence Edward Dutton, Major U.S.A. Pp. 314. London: John Murray. 1904. Price 6*s*. *net*.

These two works, differing as they do in character, are alike in proving the ascendency of the new seismology and the direction in which the science is trending. Time was when earthquakes were regarded as belonging solely to the geologist; they were considered as the cause of the upheaval of mountains and the contortion of strata, but it became gradually recognized that the earthquake is an effect, not a cause; the discovery that the cryptoseismic disturbance, set up by a great earthquake, could be recognized all over the world, ushered in the new seismology and a new series of problems. Seismology has become more and more a science of wave-motion, and the study of the effects of earthquakes, which belongs rather to geography and engineering than to geology, is in danger of being neglected.

The first of the two works heading this notice is a compilation pure and simple, from sources so limited that the list of principal authorities consulted does not mention the name of Mallet nor the transactions of the Seismological Society of Japan. The sections devoted to the old seismology are scanty, and follow strictly on the lines of previous text-books; the sections devoted to the modern development of long-distance observations are more complete, but the limitation of the sources of information consulted by the author has in more than one case led to his ascribing priority to the wrong person. The most remarkable instance of this is where he attributes the initiation of earthquake investigation in Japan to Knipping and Naumann—an injustice to his own countryman Wagner, who introduced the use of the multiplying index in seismographs and constructed the instrument with which Knipping worked. It must, however, be allowed that the compilation, so far as it goes, is well done, and the book is in a manner up to date, for the paper by Prof. Milne in this *Journal* of January, 1904, is fully noticed.

Of a very different character is the second book. Himself a master of the old seismology, Major Dutton has a thorough knowledge of, and sympathy with, the new; practised both as an observer and a writer, he has produced what is indubitably the best handbook of seismology now available, and the only fault to be found is that the space required for its recent developments has crowded out what is the most practically important branch of the science—that is to say, the effects of earthquakes on human constructions, and the means of minimizing, if not preventing, the havoc wrought by them.

Too much importance is, perhaps, given to the supposed distinction between quakes of volcanic origin and dislocation or tectonic earthquakes, and in devoting an entire chapter to each of these classes Major Dutton seems to have followed his Teutonic predecessors in attributing importance to a distinction of doubtful validity. With few, if any, exceptions, all earthquakes—not counting as such the tremors which originate naturally or artificially at the surface of the ground—arise from a sudden relief of strain: the rocks composing the crust of the Earth are thrown into a state of strain, which gradually increases in amount till it becomes too great to

be resisted any longer, fracture follows, and the disturbance set up, propagated as wave-motion, constitutes what is known as an earthquake. To this cause must be attributed not only all tectonic earthquakes, but also the greater part of those classed as volcanic, and the difference in general character between the two may be attributed to the fact that in volcanic regions strain and fracture seem to take place at a lesser depth from the surface.

There is, however, another conceivable cause of earthquakes, in the sudden development of strain, whether by increase or decrease of pressure, as might be produced by the admission of high-pressure steam to a pre-existing fissure, or by its sudden condensation in a subterranean cavity. Neither of these modes of origin has been established in any single instance, though they seem probable in some, but the distinction between earthquakes which are due to a sudden relief of pre-existing strain and those due to a sudden production of strain seems more logical than the usual one between volcanic and tectonic earthquakes. In any case, the determination of the ultimate cause, though doubtless of interest from a geological point of view, is far from having the seismological importance as regards the resulting earthquake, which might be supposed from the space devoted to it in text-books.

One of the most important problems of seismology is the determination of the depth at which earthquakes originate. One method after another has been proposed, only to be abandoned as its failure to give a true answer became apparent, and Major Dutton has himself invented a method which he believes to be sound, and which would be sound if its application were not vitiated by a logical fallacy. In the formula he uses the term "intensity" in the sense of energy per unit of wave-front, but in the application in the sense of a degree of the Rossi-Forel scale, which, like every other scale proposed in place of it, is miscalled a scale of intensity, being in fact a scale of acceleration, or, more simply, violence of shock. The two are very different, and differ in their rate of variation with distance from the origin, so that we are still left with no certain and trustworthy method of determining the depth at which earthquakes originate, but have, on the other hand, a lesson in the danger of misusing words.

In that part of the book which has been dealt with it is no better, unless in style, than others already in existence, but where it comes to deal with the new seismology it stands alone, for there is no other simply worded and brief account of this branch of the science, which has grown so rapidly during the last decade. There is a good and sufficiently complete account of the instruments which have recorded earthquakes at over 10,000 miles from their origin, and an account of the results which have been obtained. At a distance of more than 20° or 30° from the origin the disturbance registered, by one of these instruments, comprises three distinct phases, often with the appearance of three distinct disturbances, between each of which the instrument comes to rest. The first two phases constitute what are known as the preliminary tremors, and the author adopts the view, which is still the more probable one, that they are mass waves propagated through the Earth, while the third phase is due to surface waves propagated along or near its surface. The first phase is pretty generally regarded as representing the condensational wave, the second is possibly the distortional wave, but the third is the great problem of modern seismology. Five years ago we knew a great deal about these third-phase waves; they resembled the radiating ripples on a pond, and we calculated their length and height, but now these ideas have been cast into the melting-pot, and the new ones have not yet been moulded.

It is unfortunate that the book was completed too soon to make use of Prof. Horace Lamb's important researches, which have done much to indicate the

nature of the wave-motion to be looked for, and regrettable that no use is made of the records of the very ingeniously devised Vincentini seismographs, probably from the imperfect publication of these records, which has led to the important indications they yield being almost entirely overlooked by seismologists. This is no place to enter on the discussion of a very controverted subject, but it is permissible to suggest that too little attention is generally paid to the fact that the disturbance recorded by a seismograph is but the superficial manifestation of the wave-motion, which has travelled through the rocks below the surface. The heterogeneous, weathered, and fissured rocks of the outermost layer are incapable of transmitting any pure form of wave-motion, or, indeed, any wave-motion at all for more than a short distance, and the movement which we are able to record must have travelled, whether along a more or less direct path through the Earth or round its surface, in the more compact and homogeneous rocks which underlie the outermost layers, then been transmitted to the surface, undergoing more or less modification on its way. It is, consequently, easy to attach too much importance to such matters as amplitude and period, for these vary with the instrument employed and the site on which it is set up. If the desire is to arrive at a knowledge of the character of the wave-motion, it is a mistake to depend too much on one type of instrument alone; if, on the other hand, the aim is to investigate the rate of transmission, and from this the path followed by the earthquake waves, it is important to have a widely scattered series of instruments of the same type and similar adjustment.

In this connection Major Dutton repeats a widely spread error, in giving State aid to the organization of earthquake recording-stations, which has arisen under the auspices of the British Association. Some of our colonies and possessions have assisted by setting up and maintaining instruments in their astronomical observatories, and the same has been done in England, but the assistance has been confined to this, and there has been no Government subsidy. The work has been helped on by many workers, the funds provided by private generosity and grants from the Royal Society and the British Association, but the initiative and organization have been entirely the work of Prof. Milne, and, comparing what has been done in these circumstances with the results of State-endowed services in other countries, one is reminded of the historic conversation between Dr. Adams and Dr. Johnson, who considered that a task which had taken the French Academy forty years was not beyond the power of an Englishman to accomplish in three. So far, indeed, is our Government from assisting the work, that it is understood to be not unwilling to grant assistance, refused in its own country, to a rival organization, nominally international, but established in a province and a city which renders impossible the co-operation of the most intellectual nation in Europe.

R. D. O.

COMMERCIAL GEOGRAPHY.

Herbertson's Commercial Geography.

'Chambers's Commercial Geography of the World.' By A. J. Herbertson. London: W. & R. Chambers. 1905. *Price* 3*s.* 6*d.*

The first part of this volume is another edition of the author's 'Geography of the British Isles,' published five years ago; the second part covers the rest of the world, and the two are linked together by some chapters on general economic geography. The interest of the second part lies mainly in the plan. It is a protest against the method of the ordinary text-books, which take as a basis political areas and provide lists of unconnected facts to tax the memory of the reader. Here he finds himself carried rapidly from South Africa to South America, from Siam to Mexico, in an unconventional survey of regions. In the main, the

British Empire can be studied as a separate unit, but it is better to treat it comparatively, by keeping closely to the order of the text, which is based on similarity of physical conditions. In dealing with the great areas of the northern hemisphere, the author founds his classification rather on the various stages of economic advancement, and works from the lower to the higher—from Eastern Asia, through Russia and Europe, to the United States. The contrast to the usual arrangement is striking, and to those accustomed to the conventional system may present some difficulty. Intelligence is required of them rather than memory—a result greatly to be desired. But the book is more likely to be useful to the young student who has the advantage of competent guidance than to the unaided reader. Various tables of statistics are included in the volume, though the author is careful to state that they are merely for illustration, and designed to induce the habit of dealing with such figures in the light of geographical principles. The right way of using these, and other detailed facts, is to explain and understand; the wrong way is to commit them to memory.

A. J. S.

GENERAL.

The British Empire.

'Colonies and Colonial Federations.' By E. J. Payne. London: Macmillan. 1904. *Price* 3*s.* 6*d.*

This little book is a valuable addition to the English Citizen Series and to the general literature dealing with the colonies. In spite of the limited space at his command, the author (whose sad death is to be deplored) has succeeded in giving a vivid and stimulating picture of the past history and present condition of the empire. By grouping the facts in four sections—geographical, historical, economic and political—he has avoided many of the difficulties involved in chronological narrative and the dulness inseparable from a mere summary of unconnected details. The aim of the whole book is to attain unity of view, a unity founded largely on geographical conceptions. We start with the British people, in contact with certain physical facts; we add, as the motive power of expansion, hostile pressure from without, and the result is the Empire in its present shape. Essentially, it is a chain of communications, with a definite relation to the great trade routes of the world, and to the commercial and strategic necessities of a maritime nation. In the light of this central idea, the forging of the different links in the chain is traced; the result appears as the inevitable consequence of the policy of many generations of workers, each occupied with the needs of the moment rather than with plans for a distant future. This conception may, at times, be unduly pressed, but the resulting picture has a force and unity which no mere narrative could give. The empire is more than a chain of commercial stations, important as these are; it includes areas of a marked continental character. Certain links in the chain have provided new points of departure for the extension of colonization and the growth of great communities with a history and development peculiar to themselves.

None the less, Canada, Australasia, and South Africa, equally with Gibraltar and Malta, have strategic and commercial aspects vital to the whole system. To refuse recognition to this fact is to deny the significance of four centuries of history, and to be blind to the present teachings of geography.

On the economic side, the diversity of the products and physical conditions of the Empire is a bar to clear description; but a not unsuccessful attempt is made to introduce a certain order and unity, by a classification of regions, based on the type of civilization of their inhabitants and the relation of their products to the future needs of the world. In the economic and historical sections alike, the idea

of geographical necessity dominates the methods and views of the author, and is in part responsible for some strongly expressed opinions as to past events and current problems. The controversial character of such opinions in no way detracts from their value, as calling attention to an aspect of the colonial problem which is often neglected in current discussions.

A. J. S.

THE MONTHLY RECORD.

EUROPE.

Bremen's Commercial Importance.—A lecture delivered by Dr. F. Tetens to the *Verein. für Staatswiss. Fortbildung*, on its visit to Bremen on November 21 last, and printed in the *Deutsche Geographische Blätter* (Bd. 27, Heft 3–4), takes stock of Bremen's commercial importance, and shows how dominant is the part played in its development by physical geography. The text is illustrated by graphic tables telling their tale at a glance. The smallest of the free states of Germany, Bremen is yet in population ahead of ten others. Again, although its port ranks second in the German Empire, it is yet at a long interval from Hamburg, which boasts of much more than three times the trade of Bremen. The difficulties with which the trade of Bremen has to contend include the following: (1) The immediate environment is poor, without large industries and cities. (2) It has at great outlay to maintain its sea communication up to the requirements of the increasing magnitude of ships. From 1888 to 1895 it had, among other expensive items, to deepen its waterway to the sea to the depth of 50 feet, while the State debt of 180,000,000*m.* is due mostly to harbour improvement works. (3) The sea trade of Bremen State is divided between Bremen and Bremerhaven, the larger half falling to the latter. (4) Whereas Hamburg has for centuries been the place of transhipment between the sea and the Elbe, and therefore, in one respect, Austria-Hungary's most important seaport, the region tributary to the Weser inland is now restricted on every hand: on the west by the Rhine and the Dortmund-Ems canal, which is about to be strengthened by improved connection with the Rhine; on the south by the Rhine region, especially by the basin of the Main. Then from Bremen to Münden, in Hanover, is but 228 miles, and navigable for only 350- (metric) ton ships. The Elbe, on the other hand, is navigable 602 miles. The Maas is another rival of the Weser. Bremen's main importance, therefore, is as a *sea* harbour. Of the total sea tonnage of Germany, Bremen owned, in 1889, 26·4 per cent.; in 1903, 28·3. The growth of its cotton import is remarkable. In 1889–90 it amounted to but 500,000 bales, against 2,800,000 imported by Liverpool; in 1902–3 it reached 1,650,000, against Liverpool's import of a little over 2,000,000 bales. The inland shipping trade of Bremen, on the other hand, is incomparably smaller than that of Hamburg, nor does it bear comparison with that of the Rhine ports, Duisburg, Ruhort, and Mannheim. Hamburg's export by river alone exceeds the total export of Bremen by sea, river, and land.

Régime of the Theiss.—The hydrographic division of the Hungarian Hydraulic Works Direction at Budapest has made a thorough investigation of the *régime* of the Theiss. From a summary of the results made by Edmund von Bogolánfy, we extract the following: From the inundations, for which, more than any other, this specifically Hungarian tributary of the Danube is noted, it might readily be inferred that its bed was shallow. In reality, however, its bed from source to mouth is cut deep into the surface of the land, and most of the year the river is confined strictly within its low narrow water-channel. By the

middle of October the water is at its lowest. The discharge then amounts in the upper course to 1400–2300 cubic feet per second; in the middle course (Tokay-Szolnok) to 3500–4100 cubic feet; and in the lower course (at Szegedin) to 7000 cubic feet. Of the last half-century, 1863 was in this quarter the driest year. Yet in recent times a lower minimum than was reached that year has been several times observed, whence it is to be concluded that the bed of the river has since been deepened. This deepening is due to the regulation works of the river; the shortening, by a third, of the natural course of the river by means of cuts; and the embankment of the area of inundation. If the bed throughout the entire length of the river is filled to the brim, then approximately half the maximum high-water supply is discharged, a circumstance which in its turn reacts on the deepening of the bed. Such maxima occur in spring (March and April), in summer (June), and in autumn (October and November). It is seldom that, as in 1876, all occur in one year. But equally seldom is it for a year to pass without high-water level being once attained. It is only on the upper course that all three make themselves felt; on the middle course only the first two; on the lower course only the spring maximum. During high water the river has a discharge of 81,000 cubic feet per second in its upper course; 150,000 cubic feet in its middle course; and 120,000 cubic feet in the lower course. It is in the middle course, therefore, *i.e.* near Tokay, that the high-water volume attains its maximum. The high-water marks are in places 3 feet 8 inches to 7 feet 3 inches higher than formerly, a fact to be accounted for by the effect of the embankment. At the same time, while the duration of the inundations has diminished, the velocity of discharge has increased. The fact that the ground is mostly impermeable, together with the steepness of the fall, is the primary cause of this velocity. In the upper course the fall amounts to 5170 feet in 164 miles, or 1:161; in the middle and lower courses, on the other hand, to only 108 feet in 431 miles, or 1:21,000. There are places where the fall sinks to as low as 1:100,000. It is, therefore, only in its upper course that at high water the Theiss has the character of a torrent. In its middle and lower courses it must be classed at all stages as a quietly flowing stream. The heavy boulders are accordingly dropped at the foot of the mountains. From the beginning the Theiss has transported fine sand and mud into the Hungarian plain, and so laid the foundation for the celebrated fertility of the latter.

Banks on the Coast of the North Sea.—A barrier of islets lies off the coast of the North sea from Blaavandshuk in Jutland to Texel in Holland, and among them lie a large number of banks which are exposed at ebb tide. Dr. Eug. Warming has devoted considerable attention to the fauna of these *vader*, as they are called. The outer zone of the sandy vade he names the Arenicola zone, after the worm *Arenicola marina*, which is extremely common. This organism never leaves its horseshoe-shaped dwelling, and probably does not assist in consolidating the mud. Its zone merges into one characterized by the presence of an amphipod (*Corophium grossipes*), which plasters the walls of its holes with its excrements. Algæ also assist in increasing the depth of the layer of mud and preparing it for a higher order of vegetation. On the clayey vader plants are the chief agents in transforming the ground into saline meadows. Of animal forms, gasteropods are the most important. Scratching the surface of sandy plains covered with water during storms, Dr. Warming found a network of Phycochromaceæ 3 to 5 mm. in thickness. Diatomaceæ were also represented by a large number of species. These and many other specimens of animal and vegetable life are fully described by Dr. Wesenberg-Lund and Herre strup.

Currents in the Kattegat.—In 'Om Ytström och Bottenström i Kattegatt

af A. W. Cronander,' a number of the *Proceedings* of the Swedish Academy of Science, Messrs. Pettersson and Arrhenius deal with the theory of Prof. Cronander, put forth in his 'On the Laws of Movement of Sea-currents and Rivers,' that the wind is one of the most important causes of currents. From long series of observations made at the Fladen lightship, the authors show that the maximum velocity is not always at the surface—the mean, indeed, for the stream entering the Kattegat is greatest for a depth of 5 metres—and the velocity does not decrease towards the bottom with anything like the rapidity demanded by the Zöppritz formula, even if the wind be supposed to blow in the same direction for thirty days. The observations bear a close resemblance in character to a series recorded for the Motala river near Norrköping, and the current in the Kattegat, which as a rule extends to the bottom of the channel, is probably due to the same cause, namely, difference of level, the water being higher in the North sea or Baltic according as the water flows inwards or outwards. Double currents—a surface current and a bottom current in the opposite direction—are less frequent in the Kattegat than in the Great Belt, and are very rare in the shallower parts of the Sound. Other series of observations are adduced to prove that the theory that the salt bottom layer in the Kattegat is an under counter-current produced by the outflowing surface current is incorrect, for the fresher and salter waters move in general in the same direction. The presence of a salter bottom layer in the depths of the Baltic may be explained by the greater velocity of the inflowing current, especially at depths of 10 and 15 metres. As regards the damming up of the water by the wind, Messrs. Pettersson and Arrhenius hold that the effect is confined to the surface water, and can make itself felt to any considerable depth only when the wind blows from the same quarter for an unusually long period. Atmospheric pressure, on the other hand, affects all the layers of water to the bottom.

Currents of the Straits of Messina.—Prof. G. Platania treats of the currents of these straits in connection with interruptions in telegraphic communication. (*Rivista Maritima*, August—September, 1904.) He holds that in many cases in which damage to cables has been attributed to earthquakes, the real cause has been friction produced by currents, and points out that an investigation of these injuries, their time of occurrence, etc., would yield valuable information regarding currents all over the world. In support of his conclusions, he shows that the broken cables generally show signs of friction, and that interruptions have been more frequent in the Straits of Messina at the lunar syzygies than in quadrature, and have been less frequent since the cables were moved to the north of the straits than when they were at the narrowest point. The submarine current runs in the same direction as the surface current, and with it changes its direction every six hours. The contours of the coast and the bed of the sea render the movements more complicated, producing lateral induction and vertical currents. Atmospheric pressure and winds may also exaggerate the difference of level and prolong the duration of the surface currents in one direction, giving rise to compensation currents. A systematic course of experiments on the currents of the strait, with records of temperature and salinity determinations would be of great scientific value.

Cartography of the Balkan Peninsula.—Dr. Dragutin Derok, of Belgrade, is about to compile a new general map, in twelve sheets, of Old Servia and Macedonia, making use, for the purpose, of all the topographic materials collected in the last decade, more particularly by Jovan Cvijić and his disciples, Janković and others. It is to be engraved, photographed, and printed in Berlin. The basis of the work will be the well-known general map of Middle Europe, on the scale of 1 : 200,000, compiled by the Military Geographical Institute in Vienna, only it will

be reduced to the scale of 1:250,000. Like this, the separate sheets will form trapeziums of a polyhedrical projection, but, on the other hand, will count their meridians from Greenwich. The southern sheets especially will present new material as regards configuration, *e.g.* of the Peristeri mountain, and in the neighbourhood of Saloniki. The vertical configuration of the land will be represented by contour-lines 100 metres apart, and rendered further apparent to the eye by the aid of light hachuring with oblique illumination. The map will show much that is new in respect of the distribution of settlements, and of nomenclature. The large places in a division as small as that of the circle will, for the first time, find cartographic recognition in the new map. The orthography of the names (which will be in cyrillic character) will throughout be determined by the pronunciation of the local Slavonic races. In the delimitation of the vilayets and sandjaks, the reconstruction effected in Turkey some two years ago will, for the first time, be here taken into account. All highways and roads (even down to footpaths), post-offices, and telegraph lines will find a place. Places, moreover, in which there are Servian schools will be noted as such. The work is, in fact, especially intended for the use of such schools, as a map of the mother country (Himatskarte), no less than as a military map. It will appear in the course of the present year, and will be published by a union of young Servian geographers.

ASIA.

Mr. Huntington's New Expedition.—Mr. Ellsworth Huntington has set out, accompanied by Mr. R. L. Barrett, on a new expedition into the heart of Asia for geographical research. The travellers, who made a short stay in England *en route* for the East, give the following sketch of their proposed plans. The expedition, which is under the auspices of the Association of American Geographers, is intended to take two and a half years, during which occasional reports of progress will be sent home. It is hoped to study the physical geography (including the conditions prevailing during the glacial epoch) of the Tarim basin, with its border of mountains, the Lob Nor and Tsaidam regions. Special attention will also be devoted to the relation of the physical features to the life of the region, especially the human life and history. The route chosen is that through Kashmir to Khotan, whence a tour will be made round the borders of the Tarim basin *viâ* Kashgar and the Turfan depression to Lob Nor, the homeward journey being probably made by way of Tsaidam, Koko Nor, and China.

The Population of China.—Mr. W. W. Rockhill has made an inquiry into the probable population of China, both at various periods in the past, as deducible from Chinese records, and at the present day. The paper, which appeared in the *Smithsonian Miscellaneous Collections* (Quart. Issue, 47, Part 3), has also been issued as a reprint (Washington, December, 1904). In the first section the author discusses the bases of Chinese estimates of population, the number of individuals included in a household, and so on. From a consideration of the comparative care with which various censuses were taken, and the special causes operating as a check or otherwise, he finds that both in the middle of the eighth and the end of the eleventh century the population was not much more than 60,000,000, at the end of the thirteenth not much in excess of 75,000,000, and that during the fifteenth and sixteenth centuries it increased very slowly. In 1651, during the troublous times which accompanied the establishment of Manchu supremacy, it is placed as low as about 55,000,000, while in 1741, the census of which year is thought by Mr. Rockhill to have more closely approximated to the truth than any subsequent ones, it was returned at 143,000,000—a figure probably in excess of the reality. From this time onwards the official figures show the wildest fluctuations,

and from a careful consideration of causes tending in favour of, or against, a rapid increase of population in this period, especially the enormous number of deaths occasioned by droughts and other natural calamities, as well as by wars and rebellions, Mr. Rockhill thinks that the high official estimates are far in excess of the truth, pointing out that, in spite of the many unfavourable conditions, Chinese enumerations would have us believe the increase to be more rapid than in the most favoured countries of the world. In this he agrees with the late Mr. Colborne Baber, whose views, however, are not alluded to in the paper. In 1842 the population was probably about 250,000,000, a figure which cannot be greatly exceeded at the present day; in fact, Mr. Rockhill is inclined to place it considerably under 270,000,000. To the question whether the country is over-populated, he answers in the negative, and even holds that much of it is capable of supporting a greatly increased population, quoting in confirmation of this an opinion of Mr. F. S. A. Bourne.

AFRICA.

The Bed of Lake Rukwa again filled.—It will be remembered that travellers who visited Lake Rukwa during the nineties all reported a great shrinkage in the size of the lake, which even in the height of the rainy season did not appear to cover nearly the whole of its former bed. From a note in a recent number of *Globus* (vol. 87, No. 5, p. 84), it appears that the water-level has lately risen so as to once more fill the whole area. According to statements of Captain von Wangenheim, chief of the Bezirk of Bismarckburg, and of the missionaries Dromaux and Hamberger, the rise in the waters occurred in 1903–4, and the lake now once more bathes the site of Dr. Kayser's grave (near the north end of the depression). It would be possible to travel by boat from the mission station some 10 miles south of this spot to that on the Songwe, a distance of nearly 100 miles. It is hardly to be supposed that this state of things will be permanently maintained, but the facts quoted show that caution is needed in forming the conclusion, from isolated data, that a rapid and progressive desiccation of Central Africa is now taking place, many instances of fluctuations of water-level being probably due to periodic variations of rainfall. It would be of interest to obtain information regarding recent changes of level in the other great African lakes.

AMERICA.

Altitudes in the Canadian Rockies.—Mr. A. O. Wheeler has lately, while conducting a topographical survey of the Selkirk range for the Canadian Government, experimented on the photographic determination of the altitude of four of the great peaks visible from commanding view points in that range, viz. Mounts Columbia, Bryce, Lyell, and Forbes, and he gives the results in *Appalachia* for November, 1904. In order to test the reliability of the method for the computation of altitudes at so great distances (45 to 60 miles), that of Chancellor peak, which had already been fixed trigonometrically at 10,780 feet, was first determined, the mean obtained from four different views being 10,751 feet, or only 29 feet less than the previously obtained result; the range of the four results being only 44 feet. In the case of the four other peaks, the range was much greater—from 235 to 355 feet—the reason being the much greater obliquity of the lines of sight. The mean values obtained were as follows: Mount Columbia, 12,740 feet; Mount Bryce, 11,686 feet; Mount Lyell, 11,463 feet; Mount Forbes, 12,075 feet. These figures confirm the general accuracy of the heights given by Prof. Collie (*Journal*, May, 1903).

Prof. Davis on Glacial Erosion in Colorado.—We last month alluded to a paper by Prof. R. S. Tarr on certain valleys in Central New York, the features

of which seemed, in his opinion, to supply strong arguments against the glacial erosion theory. The opposite view is once more vigorously championed by Prof. W. M. Davis in a paper in *Appalachia* (Boston, November, 1904), in which he describes his observations during a visit, last July, to that portion of the Sawatch range which drains into Twin lakes and thence into the Arkansas. The range has many summits over 14,000 feet high, the culminating point being Mount Elbert, whose domed summit reaches 14,436 feet. During the time spent on the southern slopes of this mountain and in the valley of Lake Creek, excellent local and general views were obtained of much of the area once occupied by the trunk and branch glaciers of the Twin lakes system, the broadly U-shaped trough of Lake Creek having been the channel once occupied by the trunk glacier. Prof. Davis' observations have but confirmed him in his well-known views as to the power of an ice-stream to deepen its valley, though it can hardly be supposed that they would seem equally convincing to a champion of the opposite view. As he himself points out, his case rests, not on any immediate proof of the efficiency of glacial erosion, but on the accordance of the consequences of the purely hypothetical supposition that glaciers do erode, with the facts of observation in glaciated mountain districts. It is hardly to be contested, even by the opponents of the theory, that the facts observed are consistent with great erosive action on the part of ice, could such be proved to be a reality. But it is surely permissible to postpone a definite conclusion until it has been shown that no other agency could possibly be responsible for those facts. Prof. Davis, of course, points to the existence of hanging valleys —a typical example of which was observed by him—in support of his views, and he dismisses as alike insufficient the explanation put forward by M. Kilian, of Grenoble, that they are due to the protective action of the branch glacier; that of Mr. Garwood, who attributes the existing facts to a supposed tilting of the district; and that of Heine, who calls in the greater erosive power of the main than of the side stream. May it not be, however, that, in some cases at least, the discordance of the two valleys may be due to the protective action of the ice, not in the branch, but in the main valley? For it is conceivable that the side valleys may, under special climatic conditions, be progressing towards maturity, while the ice still remains in the main valley and protects the lower portions of its flanks; the upper surface of the ice thus determining, for a time at least, the base-level of the branch valley. Prof. Davis also points out that the Sawatch range repeats the features of other glaciated ranges in the forms of its sharpened peaks and crests, which confirm the view of Richter that the sharpness of various alpine *dents*, *aiguilles*, and *Hörner* is the result of the encroachment of glacial cirques upon formerly dome-like mountains. He suggests that the frequent occurrence of summits about 14,000 feet in height in the Rocky mountains may be due to the destruction of loftier mountains by cirque encroachment. Does not this, however, involve the (no doubt quite legitimate) supposition of a *conservative* action on the part of the glaciers when a certain level, determined by climatic control, is reached?

Reclamation in the Arid Region.—The Reclamation Act, passed on June 17, 1902, has been followed by a striking amount of activity in the direction of surveys and projects for the irrigation of lands at present desert for want of water A large amount of interesting information on the subject is contained in "Water-Supply and Irrigation Paper," No. 93, of the U.S. Geological Survey (Washington, 1904), being a report on the Proceedings of the first Conference of Engineers of the reclamation service, held in Utah in September, 1903. Some of the most striking statements concerning the possibilities in the way of reclamation refer to the state of Idaho, whose agricultural development depends in large measure on the development of irrigation, the reclaimable area being at the same time larger

than in any other state in the arid belt. About 65 per cent. of the surface, or 35 million acres, is arid, and of this arid area the greater part lies within the basin of the Snake river, which must be drawn upon for any supply which may make reclamation possible in this region. It has cut its channel through the great sheet of lava to a depth, in places, of nearly 1000 feet. Thousands of acres have a fertile soil of great depth, and could easily be irrigated if water were brought to them; but the magnitude of the undertaking necessitates the adoption of schemes of comprehensive scope. The surveys already carried out show the entire feasibility of reclaiming about 600,000 acres of desert land, while the total area within the state which it is thought practicable to irrigate is placed at three million acres. In Colorado too energetic steps have been taken, sites for storage reservoirs having been surveyed at points where the valleys are broken and not suited for agriculture. Altogether at least 900,000 acres are capable of being irrigated by this great river. The amount of silt carried down renders the problem a difficult, but probably not an insuperable one. A special project of much interest is one for the diversion of a portion of the water of the Gunnison, through a tunnel 6 miles in length, into the Incompahgre, the valley of which contains some 150,000 acres of most fertile land, for the irrigation of which the Incompahgre itself is quite inadequate. This has necessitated the first precise survey of the grand cañon of the Gunnison, partly traversed by the Denver and Rio Grande railway, but of which the deepest part is in a country unknown to any except hunters, range riders, and exploring engineers. The survey has been carried out since 1900 amid great difficulties, but the result is a valuable addition to geographical knowledge. The river is confined to a channel never more than 300 feet wide from one vertical wall to the other, and falls 800 feet in 4 miles. The bottom of the main cañon is accessible at intervals, but the river can only be crossed at low water. At the proposed dam site it runs through a narrow cut only 40 feet wide.

Negroes in the United States.—According to Bulletin 8 of the U.S. Census Bureau, the negroes in the U.S. (including Alaska and Hawaii) numbered, in 1900, 9⅓ millions, a larger number probably than is to be found in any other country outside of Africa. The dark shade of population deepens from north to south, nine-tenths of the total negro population falling to the south states, five-eighths to the lower Mississippi alluvial region, while in Issaquena Co., Mississippi, there are fifteen negroes to each white. The centre of negro population, which in 1790 was in Dinwiddie Co., Va., has now shifted to Dekalb City, Alabama. More than half the negro population live in the coastal plain east of the Mississippi and in the Piedmont region. Whereas in the north and west, negroes constitute about one-fortieth of the city and one-ninetieth of the country population, they constitute in the south one-third of the population, city and country included. In each decade between 1800 and 1840, negroes increased more rapidly than whites, but they have since 1840 been increasing less rapidly. On the other hand, in thirty-eight cities of the United States (thirty-three of them outside the southern states), with at least 100,000 inhabitants, the negroes increased, between 1890 and 1900, by 38 per cent., but the whites only by 32·7 per cent. In the rest of the country the negro population has increased only 16·6 per cent., against 18·7 per cent. of increase in the white population. Whereas the median age of whites is 23·4 years, that of negroes is only 19·4, the difference being connected with the higher birth and death-rate of the negroes. As regards occupation, bread-winners, constituting 37 per cent. of the total white population and 34 per cent. of the southern whites, make up 45 per cent. of the total negro population. Three-fourths of the relatively high percentage of negro bread-winners is accounted for by the marked prevalence of female negro labour, the remainder of the account being ascribable to the fact

that negro boys and negroes over fifty-five years of age are more generally engaged in bread-winning than whites of corresponding ages. Whereas 70 per cent. of male negro workers are engaged in farming, not much more than 40 per cent. of male white workers follow that calling. Outside of farming, negroes are chiefly servants and waiters. Negro clergymen in 1900 numbered 15,528, an increase of 27·7 per cent. on the number in 1890.

AUSTRALASIA AND PACIFIC ISLANDS.

Discovery of Captain Sturt's Diary.—The interesting discovery of the diary, or rather of a portion of the diary, kept by Captain Sturt during his attempt to reach the centre of Australia in 1844–5, was made last year in South Australia. The Rev. John Blackett, who describes the circumstances in the *Proceedings* of the R.G.S. of Australasia (South Australian Branch), vol. 1, 1904, received a letter from an unknown hand, stating that the diary was in the possession of the writer, whose father had been gardener to the explorer during his residence at the Grange. When Captain Sturt left for England, the diary was left behind as rubbish, but was preserved by the gardener's wife. It is, unfortunately, not complete, several pages being missing both at the beginning and end of the book, but it contains the daily record of Sturt's experiences from April 9 to November 10, 1845. It is thus of interest as supplementing the account published in Captain Sturt's book, 'An Expedition into Central Australia,' in the compilation of which it must have been used. The diary, some extracts of which are printed by Mr. Blackett, has been purchased by the Public Library of South Australia.

A Doubtful Island in the Pacific.—In an article bearing this title in the *National Geographic Magazine* (December, 1904), Mr. J. D. Hague discusses the possible existence of a small island in the north-eastern Pacific, between the coast of Mexico and Hawaii, and describes the various searches that have been made for such an island in this locality. It might seem an impossibility that one could exist without having long ago been definitely discovered, but it is pointed out that this part of the Pacific (lying between 15° and 19° N., 132° and 139° W.) is entirely off the regular track of ships. Most of the reports of the existence of land in this region came from whalers in the early part of the nineteenth century, and among the expeditions sent in search of the supposed islands or reefs were those of Captain Beechey in the *Blossom* (1827), and of Sir Edward Belcher with the *Sulphur* and *Starling* (1837). The former passed over the area in question without seeing any of the usual signs of land, while the latter, though making no actual discovery, saw some indications (*e.g.* the presence of the frigate pelican, etc.) which led him to think that some of the reports had been well founded, though the position might have been wrongly given. In 1839, the *Relief*, one of the vessels of the United States Exploring Expedition under Wilkes, took this route in the hope of settling the question, but, though covering more than 15° of longitude between 15° and 17° N., failed to make any discovery. Some faith continued to be placed in the old reports until, in 1899, the Fish Commission steamer *Albatross*, during her cruise with the scientific party under Prof. Agassiz, traversed the doubtful region without seeing any decided signs of land, while soundings gave depths of 2700 fathoms and upwards. In 1902, however, indications of shoal water were observed by Captain Lawless commanding the s.s. *Australia*, of the line running between San Francisco and Tahiti, and this again aroused an interest in the question. The writer of the article under notice had been deeply interested in the fate of the United States sloop-of-war *Levant*, which sailed in 1860 from Hawaii for Panama, but met with disaster in some unknown way, the only indication of its nature being afforded by wreckage found in Hawaii in 1861, which seemed

to show that the ship had been broken in pieces on rocks. The statements of Captain Lawless encouraged him to approach the United States Government on the subject of a further search, with the result that in May, 1904, the *Tacoma*, a newly built cruiser about to make a trial trip to Honolulu under the command of Commander R. F. Nicholson, was directed to visit the locality and seek for traces of the lost *Levant*, Mr. Hague taking part in the voyage. The result was again negative, for though the *Tacoma* cruised over a considerable part of the debatable area, neither land, shoals, nor signs of land were seen. It is pointed out, however, that the existence of a reef or island is not positively disproved, as there still remains an area of some 30,000 square miles not traversed by any of the search expeditions.

POLAR REGIONS.

Peary's New Expedition.—The Peary Arctic Club of New York City has been incorporated for the purpose of aiding Commander Peary in his persistent efforts to complete the geographical conquest of the large unknown area in the North Polar basin, and the members of the club have subscribed more than half of the $150,000 needed to build a ship for the expedition and equip it for the voyage, on which it starts on July 1 next. The vessel, which is to be equipped with both engines and sails, was to be launched about March 1, and is the first ever constructed in the United States for Arctic discovery.

The French Antarctic Expedition.—Some anxiety as to the safety of Dr. Charcot's expedition, which, it will be remembered, went south from Buenos Aires at the end of 1903, has been caused by the return of the Argentine gunboat *Uruguay*, which had been sent in search of the explorers, without having discovered a trace either of ship or men. On making the final start for the Antarctic, Dr. Charcot drew up a programme of his proceedings, mentioning especially the points at which records of his movements would be left, in order to facilitate any search that might become necessary (*Journal*, vol. 23, p. 262). One of these was Wiencke island, at the south-west end of Belgica strait, and this point was reached by the *Uruguay* after an adventurous voyage through masses of heavy ice, but a careful search revealed no record of Dr. Charcot's movements or other trace of his expedition. The Argentine officers express the fear that the *Français* may have been lost in the great storm of April 4, 1904. It does not appear, however, that the *Uruguay* pushed on beyond Wiencke island to the other points chosen by Dr. Charcot for the deposit of records, the turning-point being placed by the telegraphic account in 64° 57′ S. It had been Dr. Charcot's intention to seek winter quarters considerably to the south of this, so that, if it had been possible to push on to Pitt or Adelaide islands (two of the other points at which records were to have been left), a junction might perhaps have been effected with the French party. It may, therefore, be hoped that the explorer may still return north during the next month or six weeks, after which time there would, no doubt, be cause for some disquietude, as Dr. Charcot's expedition was not equipped with a view to spending a second winter in these regions.

Return of Mr. Mossmann.—News has been received in Edinburgh of the safe return to Buenos Aires of Mr. R. C. Mossmann, of the Scottish Antarctic Expedition, who, it will be remembered, remained behind at the meteorological station in the South Orkneys for the purpose of continuing the observations during a second year. He has thus spent two continuous years in the far south.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

A Great Globe.—Dr. Marsden Manson, C.E., of San Francisco, has sent us a communication relating to a globe on a scale of 1 : 1,000,000 (42 feet 3 inches in diameter). It is to be so mounted that the globe may have rotatory motions in three directions about its centre, worked by electricity. The globe is to be in a building 60 feet square and 50 feet high, surrounded on three sides by galleries. The fourth side will open to an amphitheatre. Here there will be a lantern with special lenses ground to project on a spherical surface, and so fixed that the axis passes through the centre of the globe. Photographs of the globe, or part of it, will be taken with a camera set up on the lantern stand, and lantern slides showing the distributions of various phenomena will be prepared, and when put into the lantern the proper areas on the globe will be differentially illuminated. With a proper arrangement of light, and the necessary movements of the globe, the phenomena of day and night, the seasons, eclipses, etc., will be graphically illustrated. This description will recall Prof. Reclus's proposal for a great globe (*Geo. Journal*, vol. **12**, p. 401), but we believe that the lantern arrangements are new and would form a useful supplement.

The Glacial Period in the Tropics.—The study of phenomena dating from the glacial epoch within the tropics is one of quite recent date. But a few years back our knowledge of such phenomena was virtually non-existent, but though the *data* so far collected are still very imperfect, each year sees some additions to them. Perhaps the most zealous worker in this field has been Dr. Hans Meyer, who has lately extended his researches, begun on Mount Kilimanjaro, to the Andes of Ecuador. The material collected by himself and other travellers justifies the attempt to review it from a comprehensive standpoint, and this was done by Dr. Meyer at the meeting of German naturalists at Breslau in September last, in a paper which has been printed in the *Geographische Zeitschrift* (1904, No. 11). The writer points out that the only regions whence *data* throwing light on former more extensive glaciation in the tropics are likely to be obtained, are the snowy mountains of East Central Africa, the Andes (with their extension into Mexico), and possibly also New Guinea, though our knowledge of the highest mountain chain of the island is at present practically *nil*. Taking the two former regions in turn, Dr. Meyer discusses the present and former levels both of the *névé* (giving the true *climatic* snow-line) and of the glaciers (giving the *orographical* limit of ice). He finds that there is a remarkable general agreement, not only in the existing levels throughout wide regions, but also in the extent to which they fell during the glacial epoch. The general result is to show that in the later glacial age the tropical mountain ranges were subject to an increased glaciation, the maxima of which were, in some localities at least, separated by an inter-glacial period, the earlier maximum being the more pronounced of the two. The depression of the *névé*-line during the ice age may be placed at about 500–600 metres (1650–2000 feet) within the tropics, the amount of the difference increasing regularly towards the poles. The conclusion is drawn that this symmetrical arrangement of the line of *névé* over the whole world, and the equality in the extent of its depression during the ice age in homologous climatic zones, indicate that the glacial phenomena were contemporaneous over the whole world, and disprove alike the idea that former more extensive glaciation may have been due to local causes, and the view that there was an alternation between the glaciations of the northern and southern hemispheres. The probability is that we must rather ascribe the phenomena, with Brückner, to long-period variations in the amount of the sun's heat.

GENERAL.

A New Honour for Captain Scott.—To the list of honours already bestowed on Captain Scott in recognition of his services to Antarctic discovery, must now be added the gold medal of the Swedish Geographical Society, which, we are informed by its president, Dr. Sven Hedin, was awarded to the explorer at a recent meeting.

The Successor to Ratzel.—We are pleased to learn that Prof. J. Partsch has been chosen to fill the chair of geography at Leipzig, vacant by the death of Friedrich Ratzel. Prof. Partsch was born on July 4, 1851, at Schreiberhau, in the Silesian Riesengebirge, and studied philology under Herz, and history and geography under Karl Neumann. In 1884 he became ordinary professor of geography in the university of Breslau. Originally a student of geography in its historic aspect, he became in time a master of the subject also in relation to modern natural science, and his published works coincide with the course of development of his own studies. The chief of them are as follows: 'Die Darstellung Europas in dem Geographischen Werke des Agrippa' (1875); 'Physikalische Geographie von Griechenland mit besonderer Rücksicht auf das Altertum' (1885), based on Karl Neumann's lectures; 'Philipp Clüver, der Begründer der historischen Länderkunde' (1891); 'Die Gletscher der Vorzeit in den Karpaten und den Mittelgebirgen Deutschlands' (1882); 'Die Vergletscherung des Riesengebirges zur Eiszeit' (1894). This last work has been supplemented by investigations concerning the ice age in the whole area between the regions of northern and of Alpine ice, published in separate works since 1903. His mastery of geographical description is shown in his monographs on the Ionian islands (1888–99), in his 'Schlesien' (Bd. 1, 1896); and, last not least, in his 'Mitteleuropa' (English and German, 1903–4).

Baron Toll.—At the annual meeting of the Academy of Sciences at St. Petersburg, Prof. S. T. Oldenburg, who read the yearly report of the Physical and Mathematical Section of the Academy, opened his address with the following words: "To-day I must unfortunately announce, on behalf of the Polar Committee, that the last hope of seeing the valiant travellers, Baron Edward Toll and F. G. Seeberg, return to us must be given up. Baron Toll and his companions perished in the gloom of the Arctic night, on their way across the immense, ever-moving ice-fields, intersected by open spaces and covered with high ice-hummocks, which float between Bennett island and the archipelago of New Siberia. New victims have thus been added to those who have already perished in the desire to tear aside the veil which hides the unknown pole. They have perished, but they have left us a rich inheritance of varied and precious scientific materials, which, we hope, will soon be published, and will be the best monument we can erect to their memory."

The Invention of the Compass.—Several articles have of late appeared in Italy on this subject. It seems certain that the needle was first used in navigation by the mariners of Amalfi sometime in the eleventh or twelfth centuries or a little earlier, but the inventors are unknown. Last year a paper was read at the Fifth Italian Geographical Congress by Dr. L. Posteraro, of Naples, the chief object being to prove that the credit of making the first step in turning the magnetic needle to practical purposes is due to Salomone Ireneo Pacifico of Verona (778–846 A.D.). A somewhat obscure epitaph on his tomb in the cathedral of Verona, in which the invention of a *horologium nocturnum* is ascribed to him, is interpreted by Dr. Posteraro to mean that Pacifico applied the needle to a *scaphion*, a bowl carrying a gnomon, which was used as a dial and also frequently

as an azimuthal instrument. In sunshine the instrument was set to the points of the compass by the shadow of the gnomon, and if the direction of the north pole were ascertained by the magnetic needle, it could be used to determine angles at night. If such were the invention of Pacifico, it is the earliest known application of the needle as a directive instrument.

The German Colonies.—The Foreign Office Report on the German colonies for 1902–3 (No. 3296) (Annual Series) quotes from the Imperial Chancellor's Memorandum, December, 1903, that, while unmistakably progressing, the colonies yet progress at a slower rate than is desirable. Outside East Africa and the Cameroons, labour continues a problem in Samoa, though it has been met by the importation of Chinese coolies. South-West Africa has, of course, caused the greatest anxiety, and it has been estimated that the Herero rebellion will in the end cost the imperial treasury £2,500,000. What with the return of the Boers to their own country and the departure of workmen engaged on the railway to Windhoek and the Swakopmund pier, the white population on January 1, 1903, was but eight more than a year earlier, or 4682 in all, including 453 British, an increase of one only. The railway receipts, 1902–3, were £44,349, the working expenses £66,768, while £30,000 has been voted for repair of the damage done by the Hereros. The pier, again, has since its opening on February 12, 1903, suffered so seriously from the impact of the sea and silting that the Colonial Press recurs to the idea of the acquisition of Walfish bay by exchange or otherwise. The Otavi railway, provided for in the mining concession, is to run direct from Swakopmund to Otavi district, a length of 354 miles. Begun in the autumn of 1903, it was to be finished in two and a half years, but the work has been interrupted by the rising. The total trade of the German colonies, imports and exports, in 1902–3, amounted to £3,140,000, an increase of £344,000 as compared with 1901–2, representing a gain of more than one-third in four years. While the imports in these four years had risen by but 30 per cent., the exports had increased by 55 per cent. The total colonial trade during 1902–3 increased, moreover, in spite of the fact that, in consequence of the cessation of large public works, such as harbours and railways, the imports on Government account were considerably diminished. Kiau-Chau is specially dealt with, but as it is the subject of a separate note (*ante*, p. 211), there is the less occasion to refer to it here. Since its occupation Kiau-Chau has cost the imperial treasury almost as much per annum (£612,000) as all the other German colonies together, but by way of compensation, the advance has been most striking. To German occupation are due an excellent inner harbour, a whole quarter of European villas, two new Chinese towns, and a large hotel. Its trade in 1902–3 was double that of 1901–2.

A Photographic Pocket-book.—Messrs. Burroughs, Wellcome & Co. have just published the 1905 edition of their useful little photographic pocket-book for travellers, 'Wellcome's Photographic Exposure Record and Diary.' In addition to the information generally given, which has become familiar to many, and which has now been thoroughly revised, several important alterations and additions have been made. The monthly light tables, hitherto printed amongst the diary tables, are now transferred to a special section at the end of the book. They are so arranged that light tables face the exposure calculator. As each month goes by its light table is removed, like the leaves of a calendar, and the light table for the following month is in its place. By this arrangement the opening of the book at the end gives at a glance on the left-hand page the light value for the time of year, day, hour, and atmospheric condition, whilst a single turn of the scale of the calculator on the right-hand side settles what exposure to give for any subject and with any plate. Other improvements have been made in the diary, and more space

is given for each record. The article on exposure gives complete instructions for using the calculator provided, and those desirous of obtaining information on the subject of exposure generally cannot do better than carefully read this chapter.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1904–1905.

Sixth Meeting, February 13, 1905.—Colonel Sir T. H. HOLDICH, K.C.I.E., etc., Vice-President, in the Chair.

ELECTIONS.—*Lieut. Robert Corbett Bayldon, R.N.; Colonel W. B. Capper, Director of Military Education, India; Thomas Garby Davey, F.G.S.; Ralph Jackson Davies-Colley; Robert Wilfred Hannam; C. A. W. Monckton; Joseph David Dallin Paul, M.A.; Captain Lee Oliver Fitzmaurice Stack; Alexander Taylor; Henry Franklin Yeo.*

The paper read was:—

"The Geographical Results of the Tibet Mission." By Sir Frank Younghusband, K.C.I.E.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps. *G.Z.* **10** (1904): 569–578. **Brückner.**
Die Eiszeiten in den Alpen. Von Prof. Dr. E. Brückner.

Alps. *Vierteljahrs. Naturforsch. Ges. Zürich* **49** (1904): 159–170. **Rollier.**
Die Entstehung der Molasse auf der Nordseite der Alpen. Von L. Rollier.

Alps. **Sennett.**

Across the Great Saint Bernard. The Modes of Nature and the Manners of Man. By A. R. Sennett. London: Bemrose & Sons, 1904. Size 8½ × 5½, pp. xvi., 444, and 100. *Illustrations. Price 6s. net. Presented by the Publishers.*

Will no doubt serve its purpose of putting before stay-at-home readers an agreeable picture of Alpine scenery and Swiss life. Some attempt at instruction on the natural phenomena of mountain regions, in popular form, is also made. We notice that the author appears to have no doubt that Hannibal's crossing was by the great St. Bernard.

Baltic Sea—Fisheries. **Petersen and Others.**

Conseil Perm. Internat. Explor. Mer. Publ. Circonstance, No. 13*a* (1904): pp. 58.

Die Ostsee-Fischerei in ihrer jetzigen Lage (Erster Teil). I. Uebersicht über die Seefischerei in den dänischen Gewässern innerhalb Skagens im Auftrag von Dr. C. G. J. Petersen bearbeitet von A. Otterström. II. Uebersicht über die Seefischerei Schwedens an den süd- und östlichen Küsten dieses Landes bearbeitet von Dr. F. Trybom und A. Wollebæk. *With Maps and Plates.*

Belgium. *B.S.R. Belge G.* **28** (1904): 206–224, 295–310, 358–378. **Cornet.**

Excursions de géographie physique en Flandre et en Hainaut. Par J. Cornet.

France. *Questions Dipl.* **18** (1904): 1–10, 91–105, 160–178, 220–234, 273–287. **Laffitte.**

L'expansion économique de la France. Par Prof. L. Laffitte. *With Maps and Plans.*

Takes the various regions in turn and discusses the present conditions and proposed development of lines of communications and the like.

France. *La G., B.S.G. Paris* **10** (1904): 287–294. **Mougin.**

Les poches intraglaciaires du Glacier de Tête-Rousse. Par P. Mougin. *With Maps and Illustrations.*

France—Brittany. *Tour du Monde* **10** (1904): 409–492. **Geffroy.**

La Bretagne du Sud. Par G. Geffroy. *With Illustrations.*

France—Brittany. *Ann. G.* **13** (1904): 296–309. **Robert.**

La densité de la population en Bretagne calculée par zones d'égal éloignement de la mer. Par E. Robert. *With Map.*

France—Corsica. *Ann. G.* **13** (1904): 334–347. **Vanutberghe.**

La Corse, étude de géographie humaine. Par H. Vanutberghe.

France—Hautes Alpes. *C. Rd.* **139** (1904): 434–436. **Martel.**

Sur l'*Oucane* de Chabrières (Hautes-Alpes) et l'origine des lapiaz. Note de E. A. Martel.

The subject of this note is a field of "karren" defined by two series of intersecting chasms, the characteristics of which seem to confirm M. Martel's views on the origin of such features (cf. *Journal*, vol. 21, p. 328).

Germany. *M.V. Erdk. Halle a. S.* (1904): 1–53. **Gerbing.**

Die Pässe des Thüringerwaldes in ihrer Bedeutung für den innerdeutschen Verkehr und das deutsche Strassennetz. Von W. Gerbing. *With Map.*

Germany. *M.V. Erdk. Halle a. S.* (1904): 79–83. **Halbfass.**

Ueber Einsturzbecken am Südrand des Harzes. Von Prof. Dr. W. Halbfass. *With Maps.*

Germany. *Naturw. Wochenschrift* **3** (1904): 865–871. **Stille.**

Die geologischen Linien im Landschaftsbilde Mitteldeutschlands. Von Dr. H. Stille. *With Sketch-map.*

Germany. *Z. Ges. Erdk. Berlin* (1904): 651–659. **Ule.**

Alter und Entstehung des Würm-Sees. Von Prof. Dr. W. Ule. *With Maps.*

See note in the Monthly Record for February (p. 210).

Germany—Historical. **Detlefsen.**

Die Entdeckung des germanischen Nordens im Altertum. Von D. Detlefsen. (Quellen und Forschungen zur alten Geschichte und Geographie, herausgegeben von W. Sieglin, Heft 8.) Berlin: Weidmannsche Buchhandlung, 1904. Size 10 × 6½, pp. 66.

Germany—Pomerania. *Petermanns M.* **50** (1904): 253–259. **Halbfass.**

Weitere Beiträge zur Kenntnis der pommerschen Seen. Von Prof. Dr. W. Halbfass. *With Maps.*

Germany—Thüringerwald. *M.V. Erdk. Halle a. S.* (1904): 88–90. **Gerbing.**

Die Verbreitung des Loiba-Namens im Thüringerwald. Von L. Gerbing.

Defines the area over which traces of the old name "Loiba" for the Thüringerwald are still met with in place-names, as well as the period during which it appears in literature.

Germany—Waterways. *Contemporary Rev.* **86** (1904): 778–797. **Eltzbacher.**

The Lesson of the German Waterways. By O. Eltzbacher.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **21** (1904): 941–972. **Bruyn.**

Proeve van verklaring der temperatuur-anomalieën in den St. Pietersberg bij Maastricht. Door F. de Bruyn, S.J.

Holland. *Tijds. K. Ned. Aard. Genoots. Amsterdam* **21** (1904): 1080–1089. ——

De Utrechtsch-Noordhollandsche Vecht. Door A. A. B.

The Vecht is part river, part basin, and was originally a side branch of the Rhine.

Holland—Hydrology. *K.A.W. Amsterdam, P. Sec. Sci.* **6** (1904): 738–760. **Dubois.**

Facts leading to trace out the motion and the origin of the underground water in our sea-provinces. By Prof. E. Dubois.

Holland—Place-names. **Kern.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **21** (1904): 773–786.

Iets over de oudstbekende aardrijkskundige namen in Nederland. Door Prof. Dr. H. Kern.

Italy—Sicily. **Sladen.**

Sicily, the new Winter Resort, an Encyclopædia of Sicily. By Douglas Sladen. London: Methuen & Co., [1905]. Size 8 × 5½, pp. xxiv. and 616. *Map and Illustrations. Price 5s. net. Presented by the Author.*

United Kingdom—Goodwin Sands. **Gattie.**

Memorials of the Goodwin Sands, and their Surroundings, Legendary and Historical. By G. B. Gattie. London: J. J. Keliher & Co., 1904. Size 8 × 5½, pp. xvi. and 298. *Maps, Charts, and Illustrations.*

Describes in an interesting way the present features, past changes, and historical associations of the region of the Goodwin Sands, with notes on various schemes set on foot in the interest of safe navigation.

United Kingdom—Wales. **Pritchard.**

Cardigan Priory in the Olden Days. By Emily M. Pritchard. (Olwen Powys.) London: W. Heinemann, 1904. Size 10½ × 8, pp. xiv. and 168. *Map and Illustrations. Presented by the Author.*

This work is evidently the outcome of much careful study of old records. Its interest is mainly antiquarian, but it includes the reproduction of Blaeu's map of Cardiganshire, made from a copy which, the author writes, seems to be an earlier impression than those usually found in the 'Atlas.' The representation of Cardigan priory church (of which an enlargement is given) leads her to suppose, from its resemblance to descriptions of the church as it existed in the sixteenth century, that the draughtsman was possessed of local knowledge. From what we know of the care taken by Blaeu in the collection of his material, this is quite possible, but it is to be remarked that the representations of cities with their churches show a great general resemblance throughout the atlas, while the one in question differs considerably from the drawing of Cardigan in Speed's atlas at a somewhat earlier date.

ASIA.

China. *Globus* **86** (1904): 217–218. **Reitzenstein.**

Die Silberinsel bei Chinkiang. Von Frh. v. Reitzenstein. *With Maps and Illustration.*

China. **Brown.**

From Tientsin to Peking with the Allied Forces. By the Rev. F. Brown. London: C. H. Kelly, 1902. Size 7½ × 5, pp. 126. *Illustrations. Price* 1*s.* 6*d. Presented by the Author.*

China. **Hackmann.**

Vom Omi bis Bhamo. Wanderungen an der Grenzen von China, Tibet und Birma. Von Lic. H. Hackmann. Halle a. S: Gebauer-Schwetschke, 1905. Size 9 × 7, pp. 382. *Maps and Illustrations. Price* 8*s.*

The author made the journey from Ta-chien-lu to Bhamo by routes through south-west Se-chuan, differing somewhat from those of Baber, Hosie, Jack, and others. The book is illustrated in a somewhat novel fashion, the margins being occupied by sketches of various kinds, which, though at first sight appearing somewhat fanciful, are said to all represent actual objects or scenes of the country passed through. The map is roughly drawn, and the courses of the rivers are not always shown with accuracy.

China. **Hourst.**

Seconde Mission Hourst. Dans les rapides du Fleuve Bleu. Voyage de la Première Canonnière Française sur le haut Yang-Tse-Kiang, par le Lt. de Vaisseau Hourst. Préface de M. Jules Lemaitre. Paris: Plon-Nourrit et Cie., 1904. Size 9 × 6, pp. 368. *Map and Illustrations. Price* 7*s.* 6*d.*

A popular account, by the well-known explorer of the Niger, of the survey work on the Yangtse, of which some account was given in the *Journal* for August, 1903 (vol. 22, p. 211).

China—Sechuan. *La G., B.S.G. Paris* **10** (1904): 317–320. **d'Anty.**

Explorations dans le Sseu-Tch'ouan. Par P. Bons d'Anty.

See note in the Monthly Record for February (p. 211).

China—Shantung. *Petermanns M.* **50** (1904): 251–253. **Anz.**

Aus dem zentralen Gebirgsland der Provinz Schantung. Von W. Anz. *With Map.*

China—Shantung. *Z. Kolonialpolitik* **6** (1904): 570–667. **Berensmann.**

Wirtschaftsgeographie Schantungs unter besonderer Berücksichtigung des Kiautschougebiets. Von Dr. Berensmann.

Noticed in the Monthly Record for February (p. 211).

China—Yunnan. **Courtellemont.**

Gervais Courtellemont. Voyage au Yunnan. Paris: Plon-Nourrit et Cie., 1904. Size 7½ × 5, pp. xiv. and 298. *Map and Illustrations. Price* 3*s.*

The journey was alluded to in the December number (vol. 24, p. 676). The book is well illustrated from photographs, and besides a small outline-map of Indo-China, there is a sketch of the bend of the Yangtse near Li-kiang.

Chinese Empire—Tibet. **Candler.**

The Unveiling of Lhasa. By E. Candler. Second Impression. London: E. Arnold, 1905. Size 9¼ × 6, pp. xvi. and 304. *Map and Illustrations. Price* 15*s. net. Presented by the Publisher.*

Chinese Empire—Tibet. ———

East India (Tibet). Further Papers relating to Tibet. No. III. London: Wyman & Sons, 1905. [Cd. 2370.] Size 13 × 8½, pp. xxvi. and 278. *Price* 2*s.* 5*d.*

Chinese Empire—Tibet. *Tour du Monde* **10** (1904): 217–240. **Narzounof.**

Trois voyages à Lhassa (1898–1901). Par O. Narzounof, pèlerin Kalmouk. *With Map and Illustrations.*

Eastern Asia. **Schön.**

Der Kriegsschauplatz in Ostasien. Geographische Beschreibung und Würdigung. Von Major J. Schön. Zweite Auflage. Berlin und Leipzig: F. Luckhardt, 1904. Size 9½ × 6½, pp. 310. *Maps. Price* 5*s.*

A detailed geographical description of the present theatre of war.

India. **Gore.**

Survey of India. Professional Paper—No. 1 (second edition). On the Projection for a map of India and adjacent Countries on the scale of 1: 1,000,000. By Colonel St. G. C. Gore, C.S.I. Dehra Dun, 1903. Size 11 × 8½, pp. 10. *Index Map.*

Describes the modified secant conical projection which it has now been decided to use instead of the ordinary one originally proposed.

India—Baltistan. *M.K.K.G. Ges. Wien* **47** (1904): 247–260. **Pfannl.**

Von meiner Reise zum K_2 in den Bergen Baltistans. Von Dr. H. Pfannl.

The writer was a member of the Eckenstein expedition.

India—Jammu. *Mem. Geolog. Surv. India* **32** (1904): 189–263. **Simpson.**
Report on the Jammu Coal-fields. By R. R. Simpson, B.SC. *With Map and Plates.*
See note in the February number (p. 210).

India—Kashmir. *Records Geolog. Surv. India* **31** (1904): 142–161. **Oldham.**
Note on the Glaciation and History of the Sind Valley, Kashmir. By R. D. Oldham. *With Plates.*

India—Mount Everest. *Nature* **71** (1904): 42–46. **Burrard.**
Mount Everest: the story of a long Controversy. By Major S. G. Burrard, F.R.S.
A brief reply by Mr. Freshfield appeared in the next number of *Nature.*

India—Seismology. *Mem. Geolog. Surv. India* **35** (Pt. 3) (1904): pp. 42. **Ballore.**
The Seismic Phenomena in British India, and their connection with its Geology By Count F. de Montessus de Ballore. *With Maps.*

Japan. **Sladen and Lorimer.**
More Queer Things about Japan. By D. Sladen and N. Lorimer. To which are added "The Letters of Will Adams," written from Japan, 1611–1617, reprinted by special permission from the papers of the Hakluyt Society; and "A Life of Napoleon," written and illustrated by Japanese in the first half of the nineteenth century. London: A. Treherne & Co., 1904. Size 9 × 6, pp. xl. and 484. *Illustrations. Presented by the Publishers.*

AFRICA.

British West Africa. **George.**
The Rise of British West Africa, comprising the early history of the Colony of Sierra Leone, the Gambia, Lagos, Gold Coast, etc. With a brief account of Climate, the Growth of Education, Commerce, and Religion, and a comprehensive history of the Bananas and Bance Islands and sketches of the constitution. By C. George. London: Houlston & Sons, 1903. Size 9 × 6, pp. x. and 468. *Price* 12*s. net. Presented by the Publishers.* [To be reviewed.]

East Africa. *Z. Ges. Erdk. Berlin* (1904): 522–523. **Uhlig.**
Von der Ostafrikanischen Expedition der Otto Winter-Stiftung. Mitteilung des Leiters der Expedition, Prof. Dr. C. Uhlig.
Cf. note in the January number (p. 92).

East Africa—Europa Island. *Z. Ges. Erdk. Berlin* (1904): 426–451. **Voeltzkow.**
Berichte über eine Reise nach Ost-Afrika zur Untersuchung der Bildung und des Aufbaues der Riffe und Inseln des westlichen Indischen Ozeans. Von Prof. Dr. A. Voeltzkow. V. Europa-Insel. *With Map. Also separate copy, presented by the Author.*

Egypt. **Garstin.**
Public Works Ministry. Report upon the Administration of the Public Works Department in Egypt for 1903. By Sir W. Garstin, G.C.M.G. Cairo, 1904. Size 11 × 7½, pp. 430. *Plans and Diagrams.*

Egypt. *Z. Ges. Erdk. Berlin* (1904): 574–593. **Schweinfurth.**
Die Umgegend von Schaghab und el-Kab (Ober-Ägypten). Von Prof. Dr. G. Schweinfurth. *With Maps and Illustrations.*

Egypt—Anthropology. **Chantre.**
Recherches anthropologiques dans l'Afrique Orientale: Égypte. Par E. Chantre. Lyon: A. Rey & Cie., 1904. Size 15 × 11½, pp. xviii. and 318. *Illustrations. Presented by the Author.* [To be reviewed.]

Egypt—Anthropology. **Chantre.**
Société d'Anthropologie de Lyon. Les Soudanais orientaux émigrés en Égypte. Esquisse ethnographique et anthropométrique. Par E. Chantre. Lyon: A. Rey & Cie., 1904. Size 9 × 6, pp. 48. *Illustrations.*

Eritrea. *L'Esplorat. Com.* **19** (1904): 232–241. **Belloni.**
Da Barentù al Setit, e a Godofelassi. Note di viaggio. Tenente G. Belloni.

Eritrea. **Kaiser.**
Die Kolonie Eritrea und ihre Besiedelung durch die Italiener. Von A. Kaiser. (Separatabdruck aus den "Mitteilungen der ostschweizerischen geographisch-commerziellen Gesellschaft St. Gallen," 1904.) Size 9 × 6½, pp. 20.

French West Africa. *Rev. Colon.* (1904): 141–143. **Desplagnes.**

Découverte des ruines de Koukiya, rapport du lieutenant Desplagnes.

See note in the Monthly Record for February (p. 215).

German East Africa. *Deutsch. Kolonialblatt* **15** (1904): 527–533. **Schleinitz.**

Bericht des Hauptmanns Freiherrn v. Schleinitz über seine Reise durch das Massaigebiet von Ikoma bis zum ostafrikanischen Graben im März 1904. *With Map.*

Journey through the districts north of Lake Eyassi.

German East Africa. *Deutsch. Kolonialblatt* **15** (1904): 533–535. ——

Der Bau der Strasse Niassa—Tanganjika.

Describes the road now being made through German territory between Nyasa and Tanganyika.

Gold Coast. *J. African S.* **4** (1904): 1–43. **Nathan.**

The Gold Coast at the end of the Seventeenth Century under the Danes and Dutch. *With Illustration.* Historical Chart of the Gold Coast and Ashanti. By Major Sir M. Nathan, K.C.M.G.

Italian Somali Coast. *L'Esporaz. Com.* **19** (1904): 305–313. **Vigoni.**

Per il Benadir. P. Vigoni.

Morocco. *Archiv. Marocaines* **1** (1904): 301–365. **Besnier.**

Géographie ancienne du Maroc (Maurétanie Tingitane). Par M. Besnier. *With Map.*

Morocco. *Archiv. Marocaines* **2** (1904): 1–99. **Salmon.**

Essai sur l'histoire politique du nord-marocain. Par G. Salmon.

Natal and Zululand. **Anderson.**

Natal. Surveyor-General's Department. Second Report of the Geological Survey of Natal and Zululand. By W. Anderson, Government Geologist. London: West, Newman & Co., 1904. Size 12 × 8½, pp. 170. *Maps and Plates. Presented by the Geological Survey of Natal.*

Nigeria. **Partridge.**

Cross River Natives, being some notes on the primitive Pagans of Obubura Hill District, Southern Nigeria, including a description of the circles of upright sculptured stones on the left bank of the Aweyong River. By C. Partridge. London: Hutchinson & Co., 1905. Size 9 × 6, pp. xvi. and 332. *Maps and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publishers.*

Miscellaneous notes on the people of a district about which very little has hitherto been written. The numerous photographs will be valuable to ethnologists.

North-East Africa. *La G., B.S.G. Paris* **10** (1904): 295–299. ——

Les communications entre Djibouti et Addis-Abeba. *With Map and Profile.*

Rhodesia. *P. Rhodesia Sci. Assoc.* **2** (1901): 5–28. **Hall and Neal.**

Architecture and Construction of Ancient Ruins in Rhodesia. By R. M. Hall and W. G. Neal.

Rhodesia. *P. Rhodesia Sci. Assoc.* **1** (1899–1900): 7–9. **Molyneux.**

Notes on some Rock Paintings in the Tuli District. By A. J. C. Molyneux. *With Plates.*

Rhodesia—Climate. *P. Rhodesia Sci. Assoc.* **2** (1901): 48–53. **Nicot**

Some features of our climate. By Rev. F. Nicot, S.J.

Rhodesia—Hot Springs. *P. Rhodesia Sci. Assoc.* **3** (1902): 9–20. **Ferguson**

The Geysers or Hot Springs of the Zambesi and Kafue Valleys. By D. Ferguson.

Rhodesia—Ruins. *P. Rhodesia Sci. Assoc.* **1** (1899–1900): 11–18. **White.**

On the Khami Ruins, near Bulawayo. By F. White. *With Plates.*

Somaliland. *J. African S.* **4** (1904): 91–108. **Kirk.**

The Yibirs and Midgàns of Somaliland, their traditions and dialects. By Lieut. J. W. C. Kirk.

South Africa. **Henkel.**

History, Resources and Productions of the country between Cape Colony and Natal, or Kaffraria Proper, now called the Native or Transkeian Territories. Compiled and illustrated by C. C. Henkel, J.P. Hamburg; London: Effingham Wilson, 1903. Size 10½ × 7½, pp. 124. *Map and Illustrations.*

The author was formerly conservator of forests in the Transkeian territories.

Sudan. *M. Seminars Orient. Sprachen* **7** (1904) (*Afrikan. Studien*) 263–269. **Bülow.**
Bericht über politische Verhältnisse im mittleren Sudan. Von von Bülow.

Sudan. *Petermanns M.* **50** (1904): 210–216. **Passarge.**
Zur Oberflächengestaltung von Kanem. Von Dr. S. Passarge.

Togo. *Deutsch. Kolonialblatt* **15** (1904): 487–488. **Seefried.**
Bericht des Oberleutnants Freiherrn v. Seefried über die Untersuchung des Hahoflusses. *With Map.*

Transvaal. *T. Geolog. S. South Africa* **7** (1904): 51–56. **Holmes.**
Some Notes on the Geology of the Northern Transvaal. By G. G. Holmes. *With Map and Sections.*

Transvaal. *T. Geolog. S. South Africa* **7** (1904): 18–26. **Mellor.**
On some Glaciated Land Surfaces occurring in the District between Pretoria and Balmoral, with Notes on the Extent and Distribution of the Glacial Conglomerate in the same area. By E. T. Mellor.
See note in the December number (p. 679).

Tripoli. *Nouv. Archiv. Miss. Sci.* **12** (1904): 1–80. **Mathuisieulx.**
Rapport sur une Mission Scientifique en Tripolitaine. Par H. Méhier de Mathuisieulx. *With Map and Plates.*
The full report on the writer's second scientific mission to Tripoli in 1903 (cf. *Journal*, vol. **22**, p. 700).

NORTH AMERICA.

Canada—British Columbia. **Morice.**
The History of the Northern Interior of British Columbia (formerly New Caledonia) [1660 to 1880]. By the Rev. A. G. Morice. Toronto: W. Briggs, 1904. Size 9½ × 6, pp. xii. and 350. *Map and Illustrations. Price* $2.50. *Presented by the Author.*
A valuable addition to our knowledge of the early history of British Columbia, based largely on original documents preserved at Fort St. James, Stuart lake.

Canada—Geological Survey.
Geological Survey of Canada. Annual Report (New Series), vol. xiii., 1900. Ottawa, 1903. Size 10 × 6¾. *Maps (separate) and Illustrations. Presented by the Geological Survey of Canada.*
Includes the summary report for the year and a number of special reports, each paged separately, which have all been issued previously.

Canada—Hudson Bay. **Low.**
Ann. Rep. Geol. Surv. Canada **13**, 1900 (1903): Reports D and DD, pp. 84 and 31.
On an Exploration of the East Coast of Hudson Bay from Cape Wolstenholme to the South End of James Bay. By A. P. Low. *Maps.*
On the Geology and Physical Character of the Nastapoka islands, Hudson bay. By the same. *Plates.*

Canada—New Brunswick. **Bailey and Poole.**
Ann. Rep. Geol. Surv. Canada **13**, 1900 (1903): Reports M and MM, pp. 38, 26.
Upon the Carboniferous System of New Brunswick, with special reference to the workable coal. By L. W. Bailey.
On the coal prospects of New Brunswick. By Henry S. Poole.

Canada—Quebec. **Bell.**
Ann. Rep. Geol. Surv. Canada **13**, 1900 (1903): Report K, pp. 11.
On the geology of the basin of the Nottaway river. By Robert Bell. *Map.*

Canada—St. Lawrence. *B. American G.S.* **36** (1904): 449–466. **Semple.**
The Influence of Geographic Environment on the Lower St. Lawrence. By E. C. Semple.

Mexico. *Mem. y Rev. S. Ci.* "*Antonio Alzate*" **20** (1903): 73–81. **Aleman.**
Observaciones de latitud en Apam practicadas por la Comisión Geodésica (Método de Talcott). Por S. Aleman.

Mexico. *Mem. y Rev. S. Ci.* "*Antonio Alzate*" **18** (1902): 159–184. **Böse.**
Sur les régions des tremblements de terre au Mexique. (Avec résumé en allemand.) Por Dr. E. Böse. *With Maps.*

Mexico. *Mem. y Rev. S. Ci. "Antonio Alzate"* **18** (1902): 267–270. **Böse.**

Breve noticia sobre el estado actual del Volcán de Tacaná (Chiapas). Por el Dr. E. Böse. *With Plate.*

Mexico. *Mem. y Rev. S. Ci. "Antonio Alzate"* **19** (1903): 137–157. **Moreno y Anda.**

El decrecimiento de la temperatura con la altitud. Por M. Moreno y Anda.

Mexico. *National G. Mag.* **15** (1904): 341–353. **Nelson.**

A Winter Expedition into South-Western Mexico. By E. W. Nelson. *With Illustrations.*

CENTRAL AND SOUTH AMERICA.

Brazil and Bolivia—Boundary. ——

Brazil and Bolivia Boundary Settlement. Treaty for the Exchange of Territories and other Compensations signed at Petropolis, November 17, 1903, together with the Report of Baron Rio Branco. New York: The Knickerbocker Press, [1904]. Size 9½ × 6, pp. 44. *Maps.*

Cf. *Journal*, vol. **23**, p. 596 *et seq.*

Chile and Argentine Republic. ——

Memoria Sobre la Demarcacion Arbitral de Limites entre Chile i la República Arjentina. Santiago de Chile, 1903. Size 11 × 8, pp. 84. *Maps.*

Colombia. *B.R.S.G. Madrid* **46** (1904): 266–271. **Arroyo.**

República de Colombia; las comunicaciones y el comercio. Por J. Maria del Arroyo.

French Guiana. **Marcel**

Un texte ethnographique inédit du XVIII^e^ siècle. Par G. Marcel. (Extrait du *Journal de la Société des Américanistes de Paris*, tome 1^er^, numero 2.) 1904. Size 11 × 7½, pp. 22. *Presented by the Author.*

The manuscript here described was written by a French doctor named La Croix towards the end of the eighteenth century. It describes his travels, and includes a chapter on the Indians of Guiana.

Grenada. ——

The Grenada Handbook, Directory and Almanac for the year 1905. Compiled by the Colonial Secretary. London: Low & Co. [E. Stanford], 1905. Size 7½ × 5, pp. viii. and 188. *Illustration. Price* 1*s.* 6*d. net. Presented by Mr. E. Stanford.*

This useful handbook includes a descriptive sketch of the colony, an official directory, statistical summary, and much other practical information.

Guatemala and Salvador. *Petermanns M.* **50** (1904): 203–210. **Sapper.**

Neue Beiträge zur Kenntnis von Guatemala und Westsalvador. Von Prof. Dr. K. Sapper. *With Maps.*

Intercontiental Railway. *B. American G.S.* **36** (1904): 466–470. ——

The Pan-American Railway. *With Map.*

Based on the official report.

Martinique. **Heilprin**

The Tower of Pelée. New Studies of the Great Volcano of Martinique. By A. Heilprin. Philadelphia and London: J. B. Lippincott Company, 1904. Size 12½ × 9½, pp. 62. *Plates. Presented by the Publishers.*

Patagonia. *B.R.S.G. Madrid* **46** (1904): 218–246. **Milanesio.**

La Patagonia: Conferencia dada por el misionero salesiano R. P. Domingo Milanesio.

Peru. *Petermanns M.* **50** (1904): 267–270. **Benrath.**

Ueber eine Eiszeit in der Peruanischen Küstenkordillere. Von Dr. A. Benrath.

Peru. *B. Cuerpo Ingen. Minas Peru*, No. 12 (1904): pp. 28. **Steinmann.**

Observaciones Geológicas de Lima á Chanchamayo. Por el Dr. G. Steinmann. *With Profiles.*

Peru. **Von den Steinen.**

Diccionario Sipibo. Castellano—Deutsch—Sipibo. Apuntes de Gramática Sipibo — Castellaro, Abdruck der Handschrift eines Franziskaners mit Beiträgen zur Kenntnis der Pano-Stämme am Ucayali, herausgegeben von K. von den Steinen.

Berlin: D. Reimer (E. Vohsen), 1904. Size 11½ × 8, pp. 40 and 128. *Presented by the Author.*

The manuscript from which this has been printed was found in 1884 by R. Payer. The introductory matter includes a sketch of European intercourse (missionary and other) with the region, and a list of tribes.

Salvador. *B.R.S.G. Madrid* **46** (1904): 272–276. **Peña.**

El lago de Güija. Por J. Maía S. Peña.

South America. *Nouv. Archiv. Miss. Sci.* **12** (1904): 81–129. **Montfort and De la Grange.**

Rapport sur une Mission Scientifique en Amérique du Sud (Bolivie, République Argentine, Chili, Pérou). Par MM. G. de Créqui Montfort et E. Sénéchal de la Grange. *With Maps.*

Reference has already been made to the scientific work of this expedition (cf. vol. **23**, p. 525; **24**, p. 482).

West Indies. **Vezey.**

Tourist Guide to the West Indies. London: published by the Royal Mail Steam Packet Company. Compiled by C. E. Vezey. 1904. Size 7½ × 10, pp. 118. *Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

New Guinea—Dutch. **Dissel.**

Tijds. K. Ned. Aard. Genoots. Amsterdam **21** (1904): 787–821.

Beschrijving van een tocht naar het landschap Bahaam. Door J. S. A. van Dissel.

New Zealand. *T. and P. New Zealand I.* **36** (1903): 225–333. **Cockayne.**

A Botanical Excursion during Midwinter to the Southern Islands of New Zealand. By L. Cockayne, PH.D. *With Maps and Plates.*

Contains much interesting information on the life-conditions of the vegetation of the Aukland, Antipodes, Bounty islands, etc., with a sketch of the history of the flora.

New Zealand—Coalfields. *T. and P. New Zealand I.* **36** (1903): 405–418. **Park.**

On the Age and Relations of the New Zealand Coalfields. By Prof. J. Park. *With Sections.*

Queensland. **Meston.**

Queensland. Report by Mr. A. Meston on Expedition to the Bellenden-Ker Range. [Brisbane], 1904. Size 13½ × 8½, pp. 18.

See note in the *Journal* for November, 1904 (p. 592).

Western Australia. *B. Geolog. Surv. W. Australia*, No. 11 (1903): pp. 58. **Maitland.**

Notes on the Country between Edjudina and Yundamindera, North Coolgardie Goldfield. By A. G. Maitland. *With Maps and Sections.*

POLAR REGIONS.

Antarctic—Argentine Expedition. *B.I.G. Argentino* **22** (1904): 9–21. **Yalour.**

El Viaje de la "Uruguay." J. Yalour.

The same number contains various papers by members of the Swedish Antarctic Expedition and the Argentine relief party.

Antarctic—Belgian Expedition. **Lecointe.**

Expédition Antarctique Belge. Au Pays des Manchots. Récit du Voyage de la *Belgica*. Par G. Lecointe. Bruxels: O. Schepens & Cie., 1904. Size 10 × 6½, pp. 368. *Maps and Illustrations. Price 6s.*

Arctic. *Vierteljahrs. Naturforsch. Ges. Zürich* **49** (1904): 128–142. **Rikli.**

Versuch einer pflanzengeographischen Gliederung der arktischen Wald- und Baumgrenze. Von M. Rikli.

Polar Regions—Temperature. *Ann. G.* **13** (1904): 289–295. **Passerat.**

La température des pôles. Par C. Passerat. *With Diagrams.*

MATHEMATICAL GEOGRAPHY.

Cartography.

New York Public Library. List of Maps of the World illustrating the progress of

geographical knowledge from the earliest times to the end of the Seventeenth Century. New York, 1904. Size 7 × 4½, pp. 38.

Catalogue of a fine collection of maps (some original, some reproductions) exhibited by the New York Public Library on the occasion of the visit of the recent International Geographical Congress. The list (though of course far from exhaustive) is representative of the most important maps of the period. There are one or two inaccuracies, and the dates of some maps of doubtful date are put down without any indication of uncertainty. A few maps of America, Africa, etc., are included.

Chronology. **Hanauer.**

A Table of the Christian and the Mohammedan Eras, from July 15, A.D. 622, the date of the Hejira, to A.D. 1900. By the Rev. J. E. Hanauer. London: Palestine Exploration Fund, [1904]. Size 8½ × 5½, pp. 24. *Presented by the Palestine Exploration Fund.*

Geodesy. *Petermanns M.* **50** (1904): 224–225. **Hammer.**

Der Längenunterschied zwischen Potsdam und Greenwich und das europäische Längennetz. Von Prof. Dr. E. Hammer.

Geodesy. **Herz.**

Geodäsie. Eine Darstellung der Methoden für die Terrainaufnahme, Landesvermessung und Erdmessung. Mit einem Anhange: Anleitung zu astronomischen, geodätischen und Kartographischen Arbeiten auf Forschungsreisen. Von Dr. N. Herz. (Die Erdkunde. Herausgegeben von M. Klar, xxii. Teil.) Leipzig und Wien: F. Deuticke, 1905 [1904]. Size 10½ × 7, pp. x. and 418. *Illustrations. Price* 14*m.*

Levelling. *Riv. G. Italiana* **11** (1904): 369–384. **Loperfido.**

Le moderne teorie della livellazione geometrica di precisione. Per A. Loperfido.

Longitude Determination. *Science* **20** (1904): 466–471. **Smith.**

Determination of Longitude. By E. Smith.

Navigation—Great Circle Sailing. *Ann. Hydrographie* **32** (1904): 375–385. **Roth.**

Studie über die Schiffahrt im grössten Kreise. Von A. Roth.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Oceanography—North Pacific. *Science* **20** (1904): 436–437. **Dall.**

Currents of the North Pacific. By Dr. W. H. Dall.

A comment on a previous communication by Dr. Bishop.

Oceanography—North Sea. **Everdingen and Wind.**

Conseil Perm. Internat. Explor. Mer, Publ. Circonstance, No. 14 (1904): pp. 10.

Oberflächentemperaturmessungen in der Nordsee. Vorläufige Mitteilung von Dr. E. van Everdingen und Dr. C. H. Wind. *With Diagrams.*

Oceanography—Tides. **Mensing.**

Der Hochseepegel und die Erforschung der Ebbe und Flut auf hohern Meere. Von A. Mensing. (Sonder-Abdruck aus der "Zeitschrift für Instrumentenkunde," 1903, November.) Berlin: J. Springer. Size 11 × 8, pp. 10. *Illustrations.*

Seismology. **Davison.**

A Study of Recent Earthquakes. By C. Davison. London and Newcastle-on-Tyne: The Walter Scott Publishing Co., 1905. Size 7½ × 5, pp. xii. and 356. *Diagrams and Illustrations. Price* 6*s. Presented by the Publishers.*

Detailed descriptions of "a few of the more important earthquakes that have occurred during the last half-century." The book will be of much value as supplementing existing text-books.

Tides. *Ann. Hydrographie* **32** (1904): 449–451. ——

Zusammenstellung einheitlicher Bezeichnungen für die Vertikal-Ausmessungen der Gezeiten.

Volcanoes. *Naturw. Wochenschrift* **3** (1904): 929–935. **Lang.**

Die Gipfelkrönungen von Vulcankuppen. Von O. Lang. *With Illustrations.*

Volcanoes. **Reclus.**

Proposition de dresser une Carte authentique des Volcans. Par E. Reclus. (Extrait du No. 11 [1903] du *Bulletin de la Société belge d'Astronomie.*) Bruxelles: Société belge d'Astronomie. Size 9½ × 6½, pp. 6. *Presented by the Société belge d'Astronomie.*

Zoo-geography—Reptiles. *P.A. Nat. Sci. Philadelphia* **56** (1904): 464–474. **Brown.**
Post-Glacial Nearctic Centres of Dispersal for Reptiles. By A. E. Brown.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial Geography. **Eckert.**
Grundriss der Handelsgeographie, von Dr. M. Eckert. 2 vols. Leipzig: G. J. Göschen, 1905. Size 9 × 6, pp. (vol. i.) xii. and 230, (vol. ii.) xvi. and 518. *Price* (vol. i.) 3.80*m.*; (vol. ii.) 8*m.* *Presented by the Publisher.* [To be reviewed.]

Historical—Columbus. **Vignaud.**
La Maison d'Albe et les Archives Colombiennes. Avec un Appendice sur les manuscrits que possédait Fernand Colomb et un tableau généalogique. Par H. Vignaud. (Extrait du Journal de la Société des Américanistes de Paris, tome 1er, No. 3.) Paris, 1904. Size 11½ × 8, pp. 18. *Presented by the Author.*

History of Geography. *B.R.S.G. Madrid* **46** (1904): 176–210. **Duro.**
La Geografía en España en los siglos xvi. y xviii. Por C. F. Duro.

History of Navigation. *Ann. Hydrographie* **32** (1904): 473–482. **Schulze.**
Pastor Mauritius Rachels Geistlich See-Kompass. Von Dr. F. Schulze.
Account of an old work intended for the use of sailors, which was written at Petersdorf in Fehmarn in 1662. It included spiritual and intellectual as well as nautical instruction.

GENERAL.

Descriptive Geography. **Ratzel.**
Ueber Naturschilderung. Von F. Ratzel. München und Berlin: R. Oldenbourg, 1904. Size 7½ × 4½, pp. viii. and 394. *Plates.* *Price* 7*s.* 6*d. net.*
A treatise on the elements of beauty and impressiveness in natural objects and scenery, and on the art of observation and description of the same. It is intended as an aid to teachers desirous of arousing an appreciation of natural beauties in their pupils.

Educational. **Becker.**
Methodik des geographischen Unterrichtes. Ein pädagogisch-didaktisches Handbuch für Lehramtskandidaten und Lehrer. Von Dr. A. Becker. (Die Erdkunde, Herausgegeben von M. Klar. III. Teil.) Leipzig und Wien: F. Deuticke, 1905 [1904]. Size 10½ × 7, pp. viii. and 72. *Price* 3*m.*

Geographical Classics. **Krümmel.**
Ausgewählte Stücke aus den Klassikern der Geographie für den Gebrauch an Hochschulen zusammengestellt von O. Krümmel. Dritte Reihe: aus Sir Charles Lyell, Eduard Suess, Ferdinand von Richthofen, A. Grisebach und J. G. Kohl. Kiel und Leipzig: Lipsius & Tischer, 1904. Size 9½ × 6½, pp. vi. and 208. *Illustrations.* *Price* 2.50*m.* *Presented by the Compiler.*
The selection in this third and last instalment has been carried out with equal judgment with that shown in the preceding (*Journal*, vol. 23, pp. 275, 806).

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Ægina Island. **Lampadarios.**
Topographical Map of the Island of Ægina. By Dr. Emm. N. Lampadarios. Scale 1 : 24,500 or 2·1 inches to a stat. mile. Athens, 1904. *Price* 5*s.*
A general map of the island, with ancient roads and sites in red. The lettering is in Greek.

Cyprus. **Bellamy.**
A Geological Map of Cyprus. Compiled by C. V. Bellamy, F.G.S. Scale 1 : 348,480 or 5·5 stat. miles to an inch. London: Edward Stanford, 1905. *Price* 6*s.* *Presented by the Publisher.*
The topographical basis of this map is Stanford's reduction of the trigonometrical survey of Cyprus, executed by Captain H. H. (now Lord) Kitchener, R.E., in 1882.

The geological data and the accompanying text are the result of observations extending over a period of five years, during which Mr. Bellamy was stationed in the island. The text gives a brief explanation of the characteristics of the various formations. The map is on too small a scale to give much detail, but the general geological features are clearly indicated by different colours, one or two of which might have been less dense with advantage.

England. **Hewlett and Kelsey.**

Lancashire and Cheshire. Scale 1 : 126,720 or 2 stat. miles to an inch. Reduced from the Ordnance Survey by E. G. W. Hewlett, M.A., and C. E. Kelsey, M.A. 2 sheets. London: Edward Stanford, 1904. *Price* 15*s. net. Presented by the Publisher.*

In many respects this is an excellent specimen of a school wall map on the tinted contour or "layer" system, and it is evident that care has been taken with its production. One good feature of the map is that only tints of one colour—burnt sienna—have been employed, instead of several different colours, as is often the case. Thus there is a gradual gradation and increase in intensity of the tint from the lowest levels to the highest, with no abrupt change from green to brown. The first two tints show the land from sea-level to 300 feet and from 300 feet to 600 feet, the next is between 600 feet and 1000 feet, and after that the tints are at intervals of 500 feet up to 2500 feet. To have kept the intervals equal, and at the same time to have brought out the leading features, would perhaps have been a difficult matter, and without increasing the number of contours and tints considerably, the results could not have been satisfactory, as so much of the land is below 1000 feet; but it might have been better if the lower lands had been shown at intervals that were some even multiples of the others—say 250 feet apart; as they are now, the 300 and 600 feet lines somewhat disturb the symmetry of the orographical tinting. Railways are shown by thin red lines, and the relative population of towns is indicated by symbols. The difference between the high and low water line around the coast is shown by different tints of blue. The heights of many points are shown by figures in feet. The map is not overcrowded with names, and is most suitable, as a specimen of this kind of map, for educational purposes.

England and Wales. **Ordnance Survey.**

Ordnance Survey of England and Wales:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from January 1 to 31, 1905.

1-inch:—

(Third edition) in outline, 19, 219, 220, 222, 237, 257, 298, 1*s. each* (engraved).
(Third edition) with hills in brown or black, 9, 12, 19, 298, 1*s. each* (engraved).

6-inch—County Maps (first revision):—

Brecknockshire, 5 N.W. **Herefordshire,** 6 S.E., 7 S.E., 10 S.W., 11 N.E., 17 N.W., N.E., S.W., 18 S.W., 19 N.E., S.E., 20 N.E., S.W., 21 N.W., 24 N.W., N.E., S.E., 25 N.W., N.E., S.W., S.E., 26 S.W., S.E., 32 S.E., 41 S.W., 47 S.W., 52 S.E. **Leicestershire,** 20 N.W. **Lincolnshire,** 145 N.E., 146 N.W., 147 S.W., 151 N.W. **Radnorshire,** 9 N.E., 10 S.W., S.E., 16 S.E., 17 N.E., 22 N.W., 23 S.E., 25 S.W., 28 N.W., 29 N.W., N.E., S.W., 30 N.W., S.W., 33 S.W., 34 N.W. **Rutland,** 5 S.E., 6 N.W., N.E., S.E., 7 N.W., 9 N.W., N.E., 11 N.W., 13 N.W., N.E., S.E. **Somersetshire,** 49 S.E., 50 S.E., 57 S.E., 60 S.W., 61 N.E., 69 N.W., N.E., S.W., 70 S.W., 72 N.W., 78 N.E., 79 N.W. **Suffolk,** 77 S.E. **Warwickshire,** 16 N.W., 17 N.W. **Worcestershire** (12 N.E. and 13 N.W.), 12 S.E., 13 N.W. and 12 N.E., 16 N.W., 23 N.W. **Yorkshire** (First Revision of 1891 Survey), 285 S.W. 1*s. each.*

25-inch—County Maps:—

Brecknockshire, VII. 8, 12; VIII. 1, 5; X. 5, 13, 14, 15, 16; XI. 6, 10, 13; XIV. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 13, 14; XX. 2, 3, 5, 6, 7, 9, 10, 13, 14, 15; XXVI. 1, 3; XXXVIII. 13; XLIII. 1, 5, 6, 8 (9 and 13), 10, 11 (13 and 9). **Carmarthenshire,** XI. 9, 13; XIX. 5, 9; L. 1, 5, 9. **Devonshire,** XVIII. 4, 8, 11, 12, 15, 16; XIX. 1, 5, 9, 13; XXI. 13, 14, 15, 16; XXIV. 12; XXVIII. 6, 7, 8, 10, 11; XXIX. 9; XXX. 4, 8; XXXI. 2; XXXII. 5, 9; XXXIV. 14, 15, 16; XXXV. 7; XXXVI. 15; XLIV. 8, 12, 15; XLV. 1, 2, 4, 5, 6, 8, 10, 11, 12; XLVI. 1, 5, 13; XLVII. 3, 7, 12; LVI. 1, 2, 3, 4, 5, 7, 8, 9, 10, 12; LVII. 5, 13, 14, 15, 16; LVIII. 13, 15, 16; LIX. 1, 6, 11, 12, 16; LXIX. 2, 3, 4, 6, 7, 10, 11, 14; LXX. 1, 2, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16; LXXI. 1, 5, 9, 13; LXXII. 1, 5, 10, 14; LXXXI. 2, 3, 4, 6, 7, 8, 10, 11, 16; LXXXII. 2, 3, 4, 6, 7, 8, 10, 11, 12, 14, 15, 16; LXXXIII. 3, 12; XCIII. 3, 4, 7, 11; XCIV. 1, 2, 3, 4, 6, 9. **Glamorgan,** III. 11. **Lincolnshire,** CXIV. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXV. 5, 15; CXXIV. 3, 7, 11, 15; CXXV. 1; CXXVI. 1, 2, 8, 9, 10, 11, 12, 13, 14, 15, 16; CXXVII. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16. **Norfolk,** CII. 2,

3, 6, 9, 10, 11, 12, 14, 15, 16; CIII. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 16; CIV. 5, 9, 13, 15; CVI. 6, 7, 8, 11; CVIII. 4; CIX. 2, 3. **Suffolk, XI.** 11, 12, 15, 16; XIII. 1, 2, 3, 5, 6, 9, 10, 13, 14, 15, 16; XIV. 10, 11, 13, 14, 16; XV. 13; XVII. 13; XX. 3, 4; XXI. 1, 2, 4; XXII. 1, 2, 3, 4; XXIII. 1, 2, 3, 4; XXIV. 2, 3. **Warwickshire,** XIV. 1, 5, 11, 12, 16; XXI. 1, 2, 5, 9, 10; XXII. 3, 4, 7, 8, 11; XXIII. 1, 2, 5, 6, 9; XXIV. 3, 4, 7, 8, 10, 11, 12, 13, 14; XXV. 2, 3, 7, 9; XXXI. 1; XLII. 4. **Worcestershire,** VI. 11, 12, 16; XVII. 13, 14; XXIV. 1; XXVII. 5; XXXV. 4; XXXIX. 8. *3s. each.*

England and Wales. **Geological Survey.**

1-inch map (New Series). Colour printed.

Reading, 268; Southampton, 315; Dorchester, 328; Weymouth, 342. Drift editions. *1s. 6d. each.*

(*E. Stanford, London Agent.*)

Germany. **Königl. Preuss. Landes-Aufnahme.**

Karte des Deutschen Reiches. Herausgegeben von der Kartographische Abtheilung der Königl. Preussische Landes-Aufnahme. Scale 1 : 100,000 or 1·6 stat. mile to an inch. Sheets: 240, Wittenberge; 264, Klötze; 289, Obisfelde. Berlin, 1904. *Price* 1.50*m. each sheet.*

ASIA.

China. **Chow and Sonne.**

Map showing the Telegraph Lines of China. By W. P. Chow and C. Chr. Sonne. Shanghai: Oriental Press, 1903.

A large roughly drawn outline map of a diagrammatic character, showing only the telegraph lines and cables. Names of places are in Chinese and English.

China. **Inspectorate-General of Customs and Post.**

Postal Working Map of China. Compiled in the Postal Secretary's Office, Inspectorate-General of Customs and Post, Peking, May 15, 1903. Shanghai: Oriental Press, 1903.

This map gives a considerable amount of information concerning the postal roads and postal districts of China. Postal towns are shown in black, and non-postal towns in brown. Telegraph stations are indicated, and other information is given. No hills are shown, and the map is only in outline. There are insets on enlarged scales of the Hankau, Canton, and Newchwang districts.

Negri Sembilan.

Map of the Negri Sembilan, Malay Peninsula. Scale 1 : 126,720 or 2 stat. miles to an inch. Compiled from Revenue Surveys. 2 sheets. Southampton: Ordnance Survey Office, 1903.

This is by far the best map that has been published of this imperfectly explored part of the Malay peninsula. It is printed in colours, and shows roads, paths, railways, telegraphs, and alienated lands—agricultural and mineral—besides giving general information as to the physical features of the country.

Persia. **Stahl.**

Routenkarte von Zentral und Nordwestlichen Persien nach eigenen Aufnahmen von A. F. Stahl. Scale 1 : 840,000 or 13·2 stat. miles to an inch. *Petermanns Geographische Mitteilungen*, Jahrgang 1905, Tafeln 1 u. 2. Gotha: Justus Perthes, 1905. *Presented by the Publisher.*

Siberia. **Guérassimoff and Meister.**

Carte géologique de la région aurifère de la Léna. Dressée par A. Guérassimoff. Scale 1 : 42,000 or 1·5 inch to a stat. mile. Sheet P6. Carte géologique de la région aurifère d'Iénisséi. Dressée par A. Meister. Scale 1 : 84,000 or 1·3 stat. mile to an inch. Sheets: K 7 and 8; L 6, 8, and 9. St. Petersburg: Comité Géologique, 1902-3. *Presented by the Comité Géologique, St. Petersburg.*

These sheets are in continuation of the geological maps of the auriferous regions of Siberia which have been in course of publication for some years. They are on sufficiently large scales to show a considerable amount of detailed geological data, and, in addition to the maps themselves, there are useful sections across the regions in different directions.

AFRICA.

Africa. **Topographical Section, General Staff.**

Africa. Scale 1 : 1,000,000 or 15·8 stat. miles to an inch. Sheet 71, Monrovia.

Price 2s. each sheet. Scale 1 : 250,000 or 3·9 stat. miles to an inch. British Central Africa. (Provisional) Sheets: 105-G, Songwe river; 105-K, Nyika plateau. *Price 1s. 6d. each sheet.* Egyptian Sudan. Sheets: 66-M, Hillet Nuer; 78-A, Ghaba Shambe. *Price 1s. 6s. each sheet.* London: Topographical Section, General Staff, War Office, 1905. *Presented by the Director of Military Operations.*

Central Africa. **Grey.**

Tanganyika Concessions, Limited. Mr. George Grey's map showing exploration and discoveries up to August, 1904. Scale 1 : 1,013,760 or 16 stat. miles to an inch. London: Whitehead, Morris & Co., [1905]. *Presented by George Grey, Esq.*

The first edition of this map, which showed the results of explorations up to September 3, 1902, was noticed in the *Geographical Journal* for July, 1903. Since then a considerable amount of exploratory and survey work has been accomplished by the company's officers, the results of which are embodied on this new edition which has just appeared. This is specially the case in the western part of the map. Much of the work is necessarily of a preliminary nature, and consists only of route surveys. No attempt has been made to give the longitudes, which perhaps, in the present state of their uncertainty, is the best course to adopt.

Egypt. **Hughes.**

New Map of the Egyptian and Sudan Goldfields. Compiled by Geo. Hughes. Scale 1 : 1,393,920 or 22 stat. miles to an inch. London: The Charto Map and Plan Co., [1904]. *Price £3 3s.*

This map shows the limits of the various mining concessions and properties of different mining companies in Egypt and the Egyptian Sudan. It also shows the location of ancient mines and old workings, in addition to wells, caravan routes, and other general information. The information from which the map has been compiled has been chiefly obtained from mining engineers and other officers attached to exploring and prospecting expeditions despatched by the different companies whose properties are shown upon the map. The style in which the map is produced is extremely rough.

German East Africa. **Sprigade and Moisel.**

Karte von Deutsch-Ostafrika. Begonnen unter Leitung von Dr. Richard Kiepert, fortgesetzt unter Leitung von Paul Sprigade und Max Moisel. Scale 1 : 300,000 or 4·7 stat. miles to an inch. Sheet F4, Gawiro. Berlin: Dietrich Reimer (Ernst Vohsen), 1904. *Presented by Herr Max Moisel.*

AMERICA.

Argentine Republic. **Greiner.**

Plano Catastral de la Gobernacion del Chubut. Por U. Greiner. Scale 1 : 750,000 or 11·8 stat. miles to an inch. 4 sheets. Buenos Aires: Libreria Alemana, 1904.

This map, which is printed in colours, has been compiled from the latest information, including the surveys of the Chile-Argentine Boundary Commissions. It is specially interesting as showing the location of the Welsh colonies. The map is well executed, and has been lithographed in Justus Perthes geographical establishment in Gotha.

Buenos Aires. **Ludwig.**

Nuevo Plano del Municipio de Buenos Aires y parte del Partido de Avellaneda. Publicado por Pablo Ludwig segun los datos mas recientes. Scale 1 : 35,000 or 1·8 inch to a stat. mile. Buenos Aires, 1904.

Panama Republic. **Military Information Division, U.S. Army.**

Map of the Republic of Panama. Scale 1 : 696,960 or 11 stat. miles to an inch. Prepared in the War Department Office of Chief of Staff, Second (Military Information) Division, General Staff, U.S. Army, January, 1904.

A somewhat roughly executed map, with soundings round the coast-line. In most parts of the interior little information is given, and the chief importance of the map is that it shows the line of the proposed canal.

GENERAL.

World. **Debes.**

Neuer Handatlas über alle Teile der Erde. Herausgegeben von E. Debes. Dritte verbesserte Auflage. Leipzig: H. Wagner & E. Debes, 1905.

This is the third edition of Debes' well-known general atlas. No new maps have been added, and the arrangement of the plates is similar to that in the earlier edition of the atlas. The excellent style in which it has been produced, and the reliable character of the information it gives, have obtained for the atlas a good reputation. In the preparation of this edition the maps have been carefully revised.

World. **Hartleben.**

A. Hartleben's Volks-Atlas enthaltend 72 Karten in Einhundert Kartenseiten. Vierte Auflage. 20 Lieferung. Vienna and Leipzig: A. Hartleben, [1904]. *Price 50 pf. each part.*

This is the concluding part of the fourth edition of this cheap general atlas, and contains the index and following plates: 27, Germany, sheet iv.; 38, Galicia and Bukowina; 70, Syria, Palestine, and Cyprus.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November and December, 1904. *Presented by the Hydrographic Department, Admiralty.*

No.	Inches.	
2287		Tidal streams round the British isles. 1*s.*
2498 m	= 2·7	Scotland, west coast:—Southern part of the sound of Raasay and Inner sound. 2*s.* 6*d.*
3441 m	= 6·9	Scotland, west coast:—Gairloch. 2*s.* 6*d.*
3422 m	= 6·8	Scotland. Hebrides:—East loch, Roag. 3*s.* 6*d.*
3444 m	= 6·9	Ireland, south-west coast:—Crookhaven, Ballydivlin, and Toormore bays. 2*s.* 6*d.*
3467 m	= var.	Iceland, plans on the north coast:—Kalshamarsnes, Blondaos, Selvig, Hagenesvig, Sandvig, Husevig, Snerstastadir, Thorshavn. 1*s.* 6*d.*
3462 m	= 5·9	British Columbia:—Southgate group and anchorage. 1*s.* 6*d.*
3464 m	= var.	Alaska. Harbours and anchorages in. 1*s.* 6*d.*
3477 m	= 4·0	Africa, west coast:—Port Forcados. 1*s.* 6*d.*
628 m	= 3·0	Africa, west coast. Bight of Biafra:—Opobo river. 1*s.* 6*d.*
839 m	= 4·0	East Indies. Andaman islands:—Port Meadows and Kotára anchorage. 1*s.* 6*d.*
3471 m	= 0·4	Sumatra:—Banka strait. 2*s.* 6*d.*
3463 m	= 0·97	Philippine islands, Mindanao, south coast:—Dumankilas bay. 1*s.* 6*d.*
3449 m	= 6·0	China, east coast:—Amoy, outer harbour. 2*s.* 6*d.*
1260 m	= {0·98 / 9·4}	China, north coast:—Ching tsu shan to Chifu bluff, including Chifu or Yentai harbour. Plan:—Chifu or Yentai landing. 2*s.* 6*d.*
3468 m	= var.	China, north-east coast. Plans on the coast of Shantung:—Malan and Lungyen coves. Yangyuchih bay. Litau bay. Ayleu bay. 1*s.* 6*d.*
3457 m	= 0·98	China, north coast:—Litau bay to Chutau, including Wei hai wei harbour. 2*s.* 6*d.*
3019 m	= {2·0 / 3·9}	Japan. Kiusiu, north-west coast:—Imari wan and approaches. Plan:—Hibi Suido. 2*s.* 6*d.*
2441 m	= 0·32	Japan:—Tsugaru strait. 2*s.* 6*d.*
3455 m	= {1·98 / 4·00}	Japan. Nipon, south coast:—Aikuchi bana to Yeboshi bana, including Nagashima wan and Kanzaki wan. Nishiki wan. 2*s.* 6*d.*
3460 m	= {1·9 / 4·0}	Japan. Nipon, south coast:—Ino hana to Aikuchi bana, including Kada wan and Owashi wan. Kuki ura. 2*s.* 6*d.*
3458 m	= var.	New Guinea. Plans of anchorages on north-east coast:—Buna roads, Oro bay, Port Harvey, Anasari harbour, Pusi Pusi harbour, Wamnea anchorage, Kitava island anchorage. 1*s.* 6*d.*
3436 m	= 0·49	New Zealand, east coast:—Plate island to Cape Runaway. 2*s.* 6*d.*
1103 m	= var.	North Pacific ocean:—Palao or Pelew islands, Korror harbour, Helen reef, Mapia island, Los Martires. 1*s.* 6*d.*
3461 m	= 2·4	Pacific. Tubuai islands:—Vavitao or Ravaïvaï. 1*s.* 6*d.*
87		Spain and Portugal, west coasts. Plan added:—Sines bay.
1128		Mediterranean sea. Sardinia, ports in. Plan added:—Arbatax road.
2634		Mediterranean sea. Syria, Ras En-Nakura to El Arish. Plan added:—Yafa anchorage.

No.
369 Cape Verde islands. Plans added:—San Filippe and Encarnaçao anchorages, port St. Jago. New plans:—Porto Praya, English road (Mayo I.).
3004 Iceland. Places on the south and east coasts. Plan added:—Vestmannaeyjar.
652 Africa, east coast. Plan added:—Mozambique anchorage.
1809 Africa, east coast. Mozambique to Ras Pekawi. Plans added:—Port Duarte Pedroso, Belmore harbour, Port Nakala.
764 South-West Pacific. New Hanover, etc. Plan added:—Peter haven.
55 South-West Pacific. New Ireland, etc. New plan:—Nusa harbour.

(*J. D. Potter, Agent.*)

Charts Cancelled.

No.	Cancelled by	No.
2498 Southern part of the sound of Raasay, etc.	Same title	2498
2184 Crookhaven. Plan on this sheet	New plan. Crookhaven, Ballydivlin, and Toormore	3444
252 Port Bona. Plan on this chart		
369 Mayo. Plan on this sheet		
628 Plans in the bight of Biafra:—Opobo river.	New plan. Opobo river	628
1809 Fernando Veloso bay. Plan on this chart.	New plan. Port Nakala	1809
2837B Plan of Abu Shahr on this chart		
839 Port Meadows.	New plan. Port Meadows and Kotára anchorage	839
1260 Chifu or Yentai harbour.	New chart.	
1256 Chifu islands anchorage. Plan on this chart.	Chingtsu shan to Chifu bluff, including Chifu or Yentai harbour	1260
3019 Tsu saki to Kagara-sima.	New plan. Imari wan and approaches	3019
2441 Tsugaru strait.	New chart. Tsugaru strait	2441
952 Nag ura. Plan on this chart.	New plans. Aikuchi bana to Yeboshi bana	3455
951 Kada bay. Plan on this chart.		
356 Owasi bay. Plan on this chart.	New plan. Ino hana to Aikuchi bana, etc.	3460
1103 Palao or Pelew islands	New sheet of plans	1103

(*J. D. Potter, Agent.*)

Charts that have received Important Corrections.

No. 1167, England, west coast:—Burry inlet. 1543, England, east coast:—Yarmouth and Lowestoft roads, etc. 1625, England, east coast:—Seaham harbour. 2296, Baltic:—Gulf of Bothnia (Sheet 1). 2646, France, west coast:—Bourgneuf to Ile de Croix. 2989, France, west coast:—Entrance to the Loire river. 2664, France, west coast:—Pointe d'Arcachon to Pointe de la Coubre. 92, Spain, west coast:—Cape St. Vincent to Gibraltar. 1567, Africa, north coast:—Approaches to Bona. 308, North America:—Gulf and river of St. Lawrence (Plans in). 2818, United States, east coast:—Hampton roads. 969, South America:—Pernambuco roads. 551, South America, east coast:—Port San Antonio, Port St. Elena. 461, Africa, west coast:—Wari and Benin rivers and creeks. 622, Africa, west coast:—Bonny and New Calabar rivers. 1810, Africa, east coast:—River Zambesi to Mozambique harbour. 665, Africa, east coast:—Zanzibar harbour and its approaches. 1235, Persian gulf:—Mouth of the Euphrates. 1419, Bay of Bengal. Andaman islands:—Long island to Port Blair. 1348, Borneo:—Natuna islands. 1180, China, east coast:—Approaches to Hongkong. 2618, China sea, Formosa, north coast:—Ke lung harbour. 1798, China, north coast:—Kwang tung peninsula, etc. 1259, Korea:—Fusan harbour. 2875, Japan, Naikai (Seto uchi). 2924, Australia,

east coast:—Cape Grafton to Hope islands. 2923, Australia, east coast:—Hope islands to Turtle group. 939, New Guinea:—Cape Nelson to Hercules bay. (*J. D. Potter, Agent.*)

Chile. **Chilian Hydrographic Office.**

Chilian Hydrographic Chart, No. 98. Tierra del Fuego. Parte occidental del Canal Beagle entre la Peninsula Brecknock i Tres Brazos. Scale 1 : 250,000 or 3·4 stat. miles to an inch. Valparaiso: Oficina Hidrografica, Marine de Chile, 1904. *Presented by the Directors of the Chilian Hydrographic Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for February, 1905. London: Meteorological Office, 1905. *Price* 6*d*. *Presented by the Meteorological Office, London.*

North Atlantic. **U.S. Hydrographic Office.**

Pilot Chart of the North Atlantic Ocean for February, 1905. Washington: U.S. Hydrographic Office, 1905. *Presented by the U.S. Hydrographic Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for February, 1905. Washington: U.S. Hydrographic Office, 1904. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Persia. **Sykes.**

Fifty-four photographs of Eastern Persia, taken by H. R. Sykes, Esq., M.A. *Presented by H. R. Sykes, Esq., M.A.*

Mr. Sykes has already presented a large number of most interesting photographs of Persia to the Society, which were noticed in the November number of the *Geographical Journal*. In addition to these, he has now added the following:—

(1) Part of a row of fifty windmills at Neh; (2) The fort at Neh, looking east; (3) Women of Neh weaving cotton fabric; (4) Bundan, entrance to the village; (5) Baluch horseman at Bundan; (6) Natives of Bundan; (7) Sistan, village of Govdars; (8) Sistan, the British consulate; (9) Sistan, the British consulate under 5 inches of snow; (10) The Mil-i-Kasimabad, Sistan; (11) View within the ancient citadel of Zahidan; (12) Ziarat of the Chehel-Pir, Sistan; (13) Outside view of the north-west corner of the citadel, Zahidan; (14) Ruins at Zahidan; (15) View of the Darvazeh-i-Nadir, a fortified gap in the mountain range 10 miles west of Nasratabad; (16) Sistan, Kuh-i-Khwaja, looking west; (17) North-east gate of ruined city of Ghaghow; (18) Ancient tombs on Kuh-i-Khwaja; (19) Ziarat of the Pir-i-Gandum on Kuh-i-Khwaja; (20) The fort of Kuk, Kuh-i-Khwaja; (21) Ruined city of Ghaghow; (22) In the Lut, Turshab, looking south-west; (23) View of Varmal; (24) Sistan, group of Sayads; (25) Baluch family and habitation, Sistan; (26) Nasratabad, in the Lut interior; (27) Nasratabad, in the Lut exterior; (28–31) Scenes from the "Tazieh," or mourning play; (32) The Kala-i-Sang, an ancient fortified capital of the Kerman province; (33) A mutilated pulpit within the ruins at the Kala-i-Sang; (34) The pinnacle of the Kala-i-Sang; (35) Rock inscriptions in the Kala-i-Sang; (36) The Shah-neshin, or King's seat, near the summit of the Kala-i-Sang; (37) Rock carvings in the Shah-neshin; (38) View of the ruins looking north, Kala-i-Sang; (39) View of the ruins looking south, Kala-i-Sang; (40) The Kala-i-Sang, looking east; (41) Ancient fortification on a rock 20 miles south of Seyidabad; (42) In the Tang-i-Niza near Hajiabad; (43) Village and villagers, Hajiabad; (44) Caravan encampment near Hajiabad; (45) Dr. Summerhayes attending a native of Hajiabad recently wounded by Afshars; (46) Village of Gakan; (47) Entrance from the north side of the Tang-i-Zagh; (48–51) In the Tang-i-Zagh; (52) In the Tang-i-Zagh, emerging at the southern end; (53) Village of Zaratu; (54) The celebrated sulphur spring at Ginao.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

PART OF THE
KARAKORAM HIMALAYA
including the
CHOGO LUNGMA, ALCHORI, HOH LUMBA AND SOSBON GLACIERS.

Surveyed by the
BULLOCK WORKMAN EXPEDITION 1903.

Scale of Miles.

5 4 3 2 1 0 5 10

Nat. Scale 1: 250,000 or 3·945 miles = 1 inch.

Route ——— *Heights in feet.*

NOTE, This map is from a plane table survey by Mr. B.H.M. Hewett, corrected by Dr. W. Hunter Workman and Mrs. Fanny Bullock Workman. adjusted to fixed points of the Indian Government Survey as laid down on Sheet 27A N.E. of the Indian Atlas with the correction to longitudes applied.
The lines lettered A & B on the Chogo Lungma Glacier, and C on the Hoh Lumba Glacier, show where measurements of the movements of the ice were made.

K

Published by the Royal Geographi

WESTERN HIMALAYAS.

SKETCH MAP

Showing the route of the

BULLOCK WORKMAN EXPEDITION

from

SRINAGAR

to the sources of the

CHOGO LUNGMA GLACIER.

1902-3.

Scale of Miles.

10 5 0 10 20 30

Nat. Scale. 1: 750,000 or 11·83 miles = 1 inch.

Route thus ——— *Heights in feet.*

75 76

36

35

75

Hispar Gl.

Choro Lungma Glacier

Mt. Haramosh 24,270

Kuppeltung Kung

Tippur Gl.

Mt. Busper

ALTISTAN

R. INDUS

Hispar Pass 17,475

Snow Lake

Col des Aiguilles (Precipice) 19,931

Camp 16,450

Mt. Kailasa 23,914

SKARDO

7701

LITTLE TIBET

Shiok R.

Burji La 15687

PLAINS OF DEOSAI

Camp 14,865

Mt. Masherbrum 22,600

Chaltoro Gl.

Braldo River

Camp 13,800

Mt. Busper 14,974

Zozi La 10,000 approx.

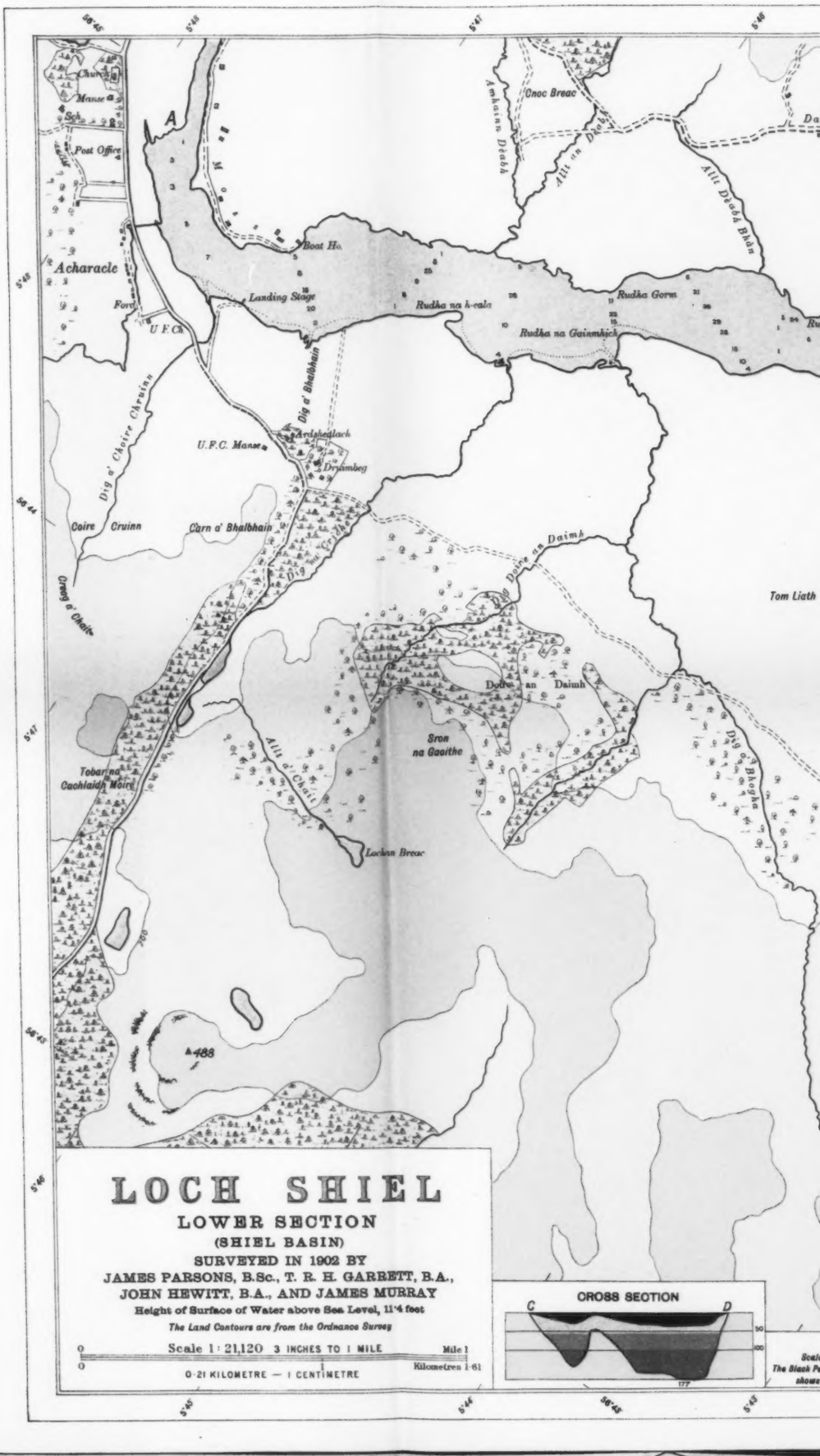
SRINAGAR (KASHMIR)

Scale of Miles.

100 50 0 100 200 300

Nat. Scale. 1: 15,000,000 or 237 miles = 1 inch.

Principal Railways ———



LOCH SHIEL

LOWER SECTION

(SHIEL BASIN)

SURVEYED IN 1902 BY

JAMES PARSONS, B.Sc., T. R. H. GARRETT, B.A.,

JOHN HEWITT, B.A., AND JAMES MURRAY

Height of Surface of Water above Sea Level, 11·4 feet

The Land Contours are from the Ordnance Survey

The Edinburgh Geographical Institute

BATHYMETRICAL SURVEY OF THE FRESH-WATER L

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULL

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
Black Part in the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

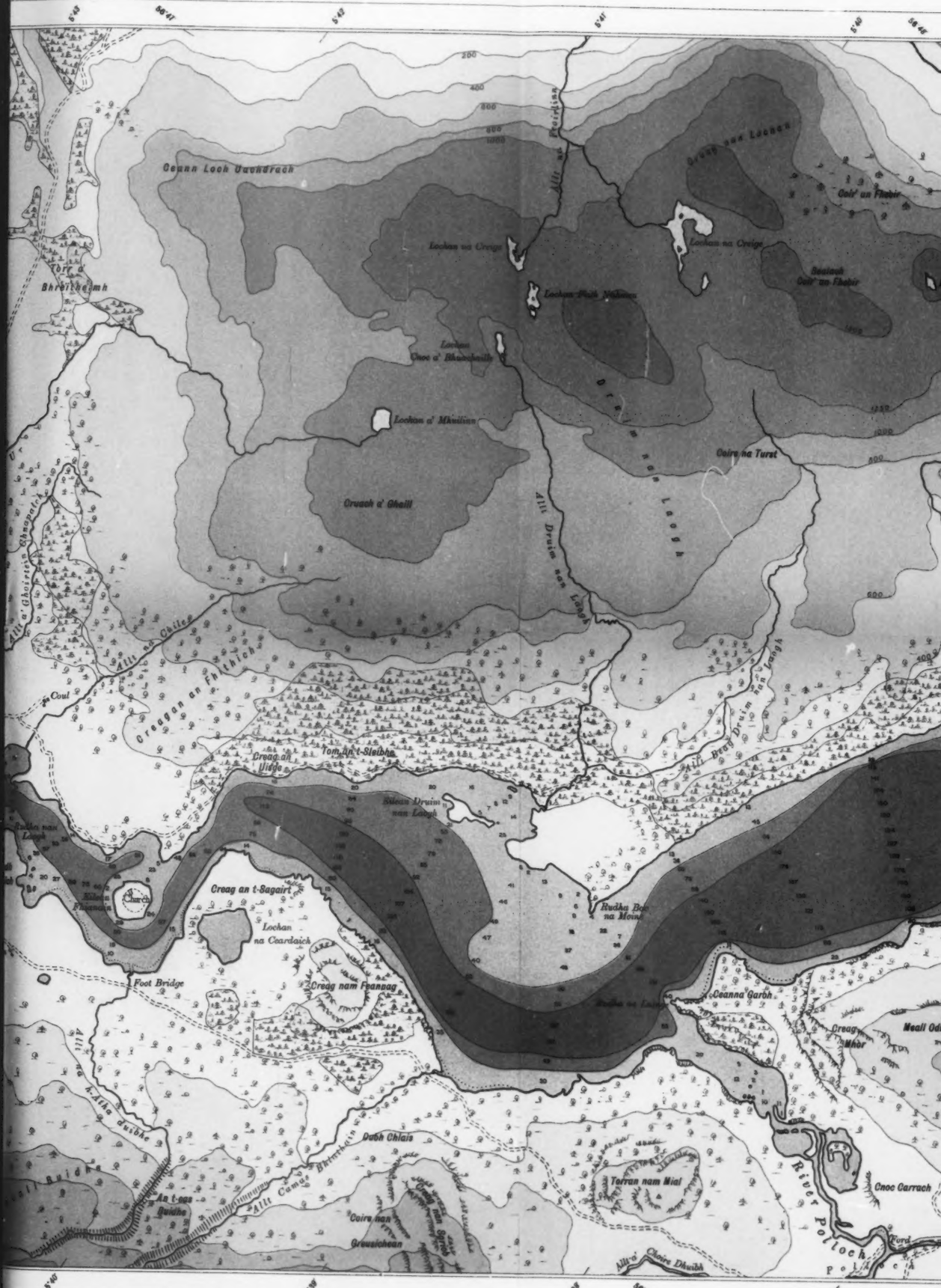
LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM

Published by the Royal Geographical Society.

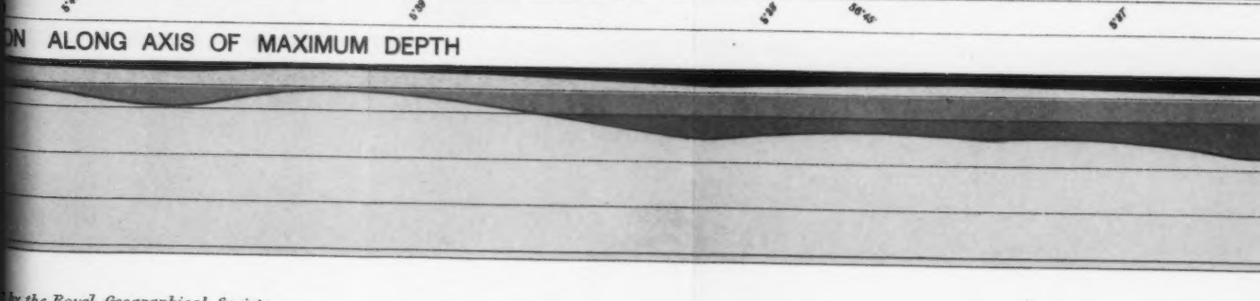
THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

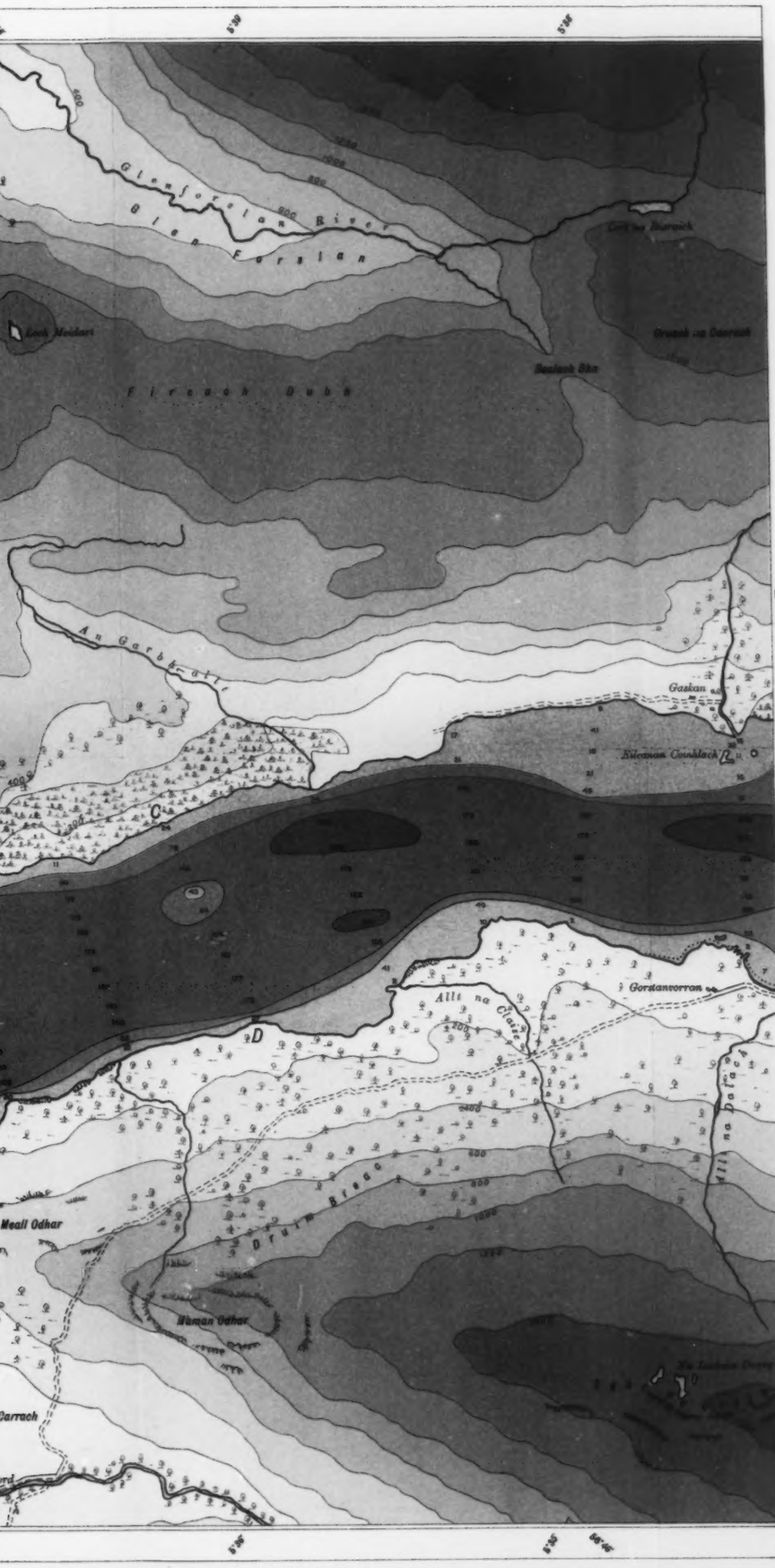
F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.

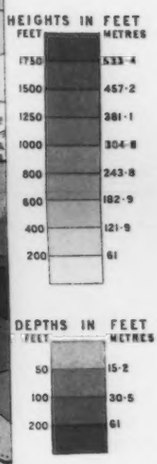


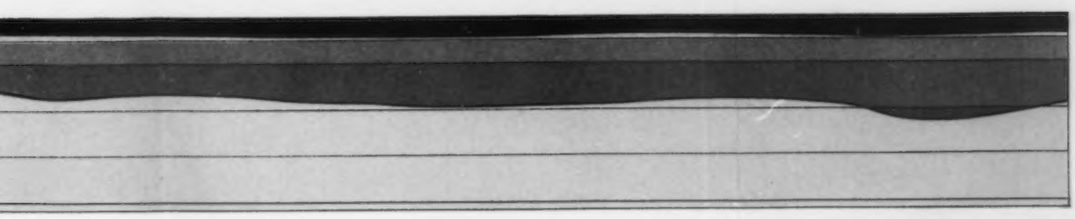
ON ALONG AXIS OF MAXIMUM DEPTH



by the Royal Geographical Society.







J. G. Bartholomew.

PLATE II

LOCH SHIEL

UPPER SECTION

(SHIEL BASIN)

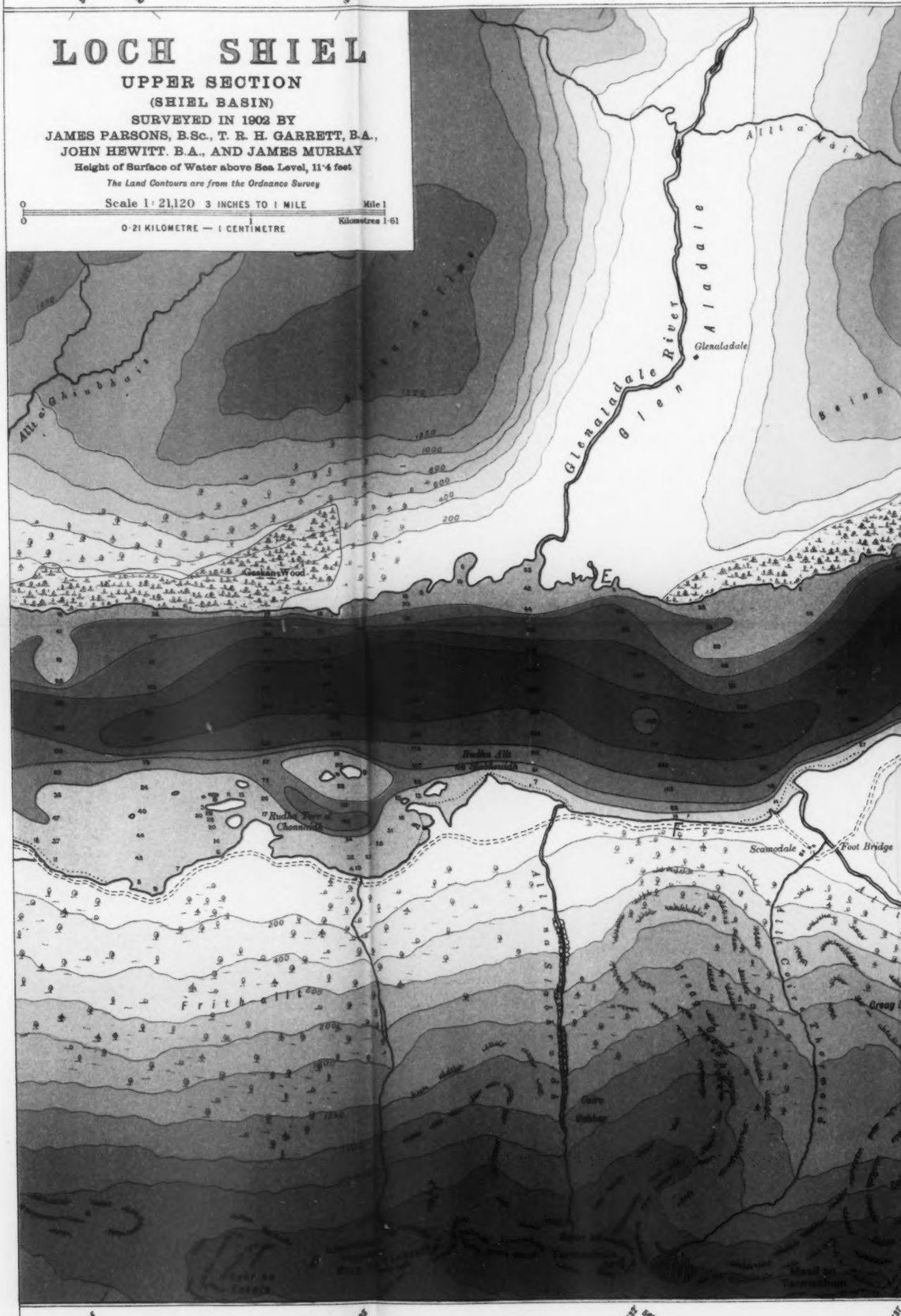
SURVEYED IN 1902 BY
JAMES PARSONS, B.Sc., T. R. H. GARRETT, B.A.,
JOHN HEWITT. B.A., AND JAMES MURRAY

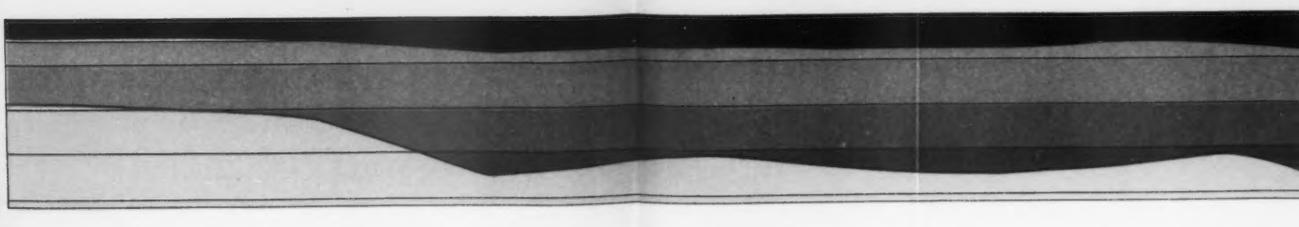
Height of Surface of Water above Sea Level, 11·4 feet

The Land Contours are from the Ordnance Survey

Scale 1 : 21,120 3 INCHES TO 1 MILE

0·21 KILOMETRE — 1 CENTIMETRE

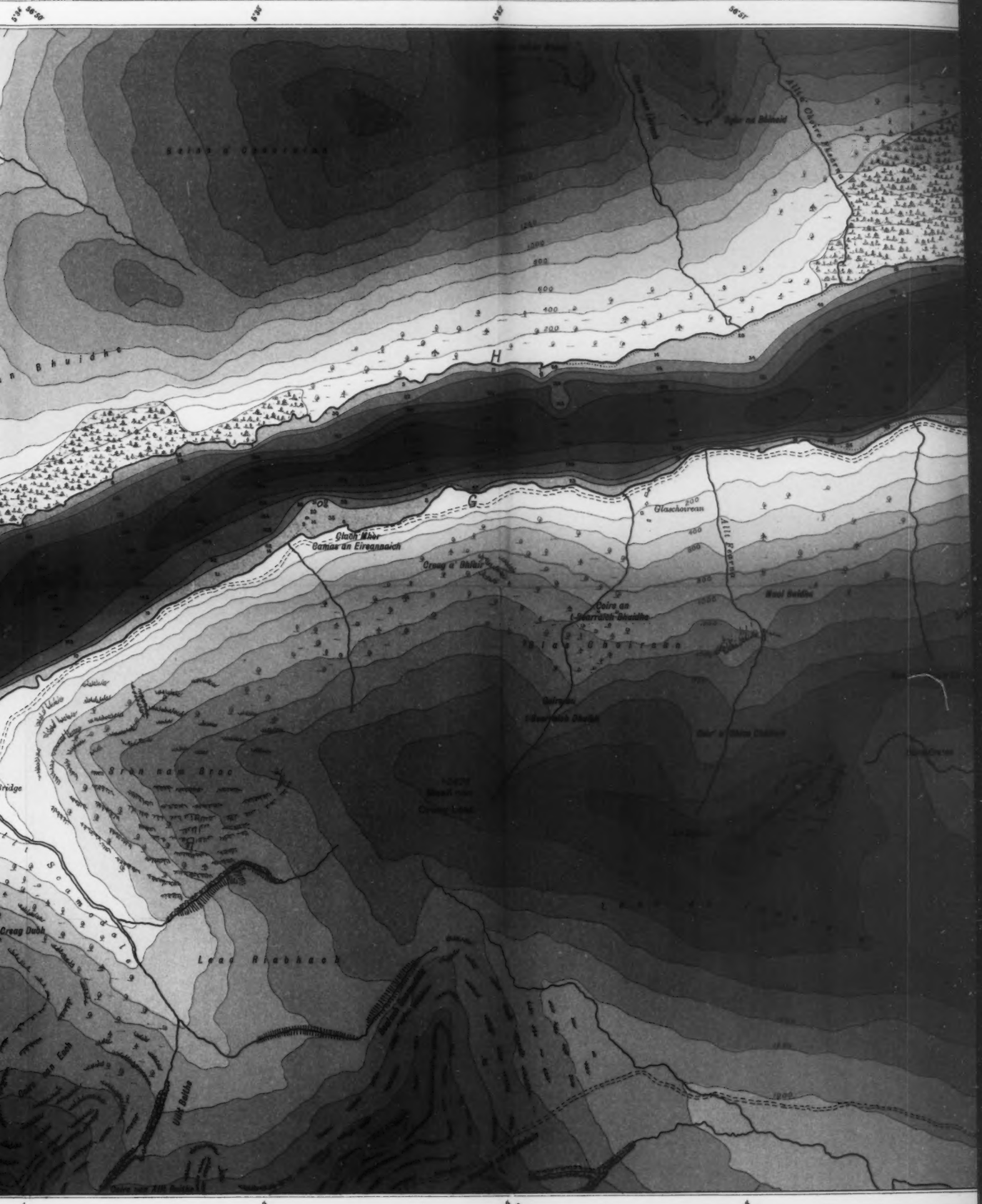




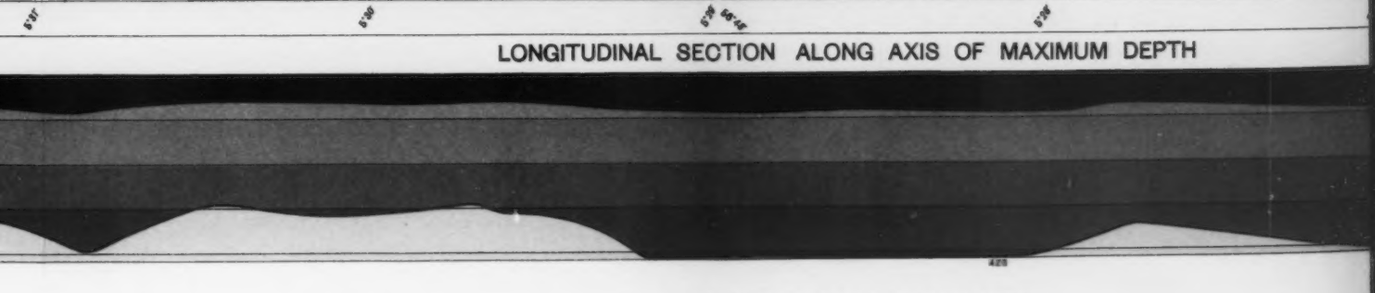
Bathymetrical Survey of the Fresh-water Lochs of Scot

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



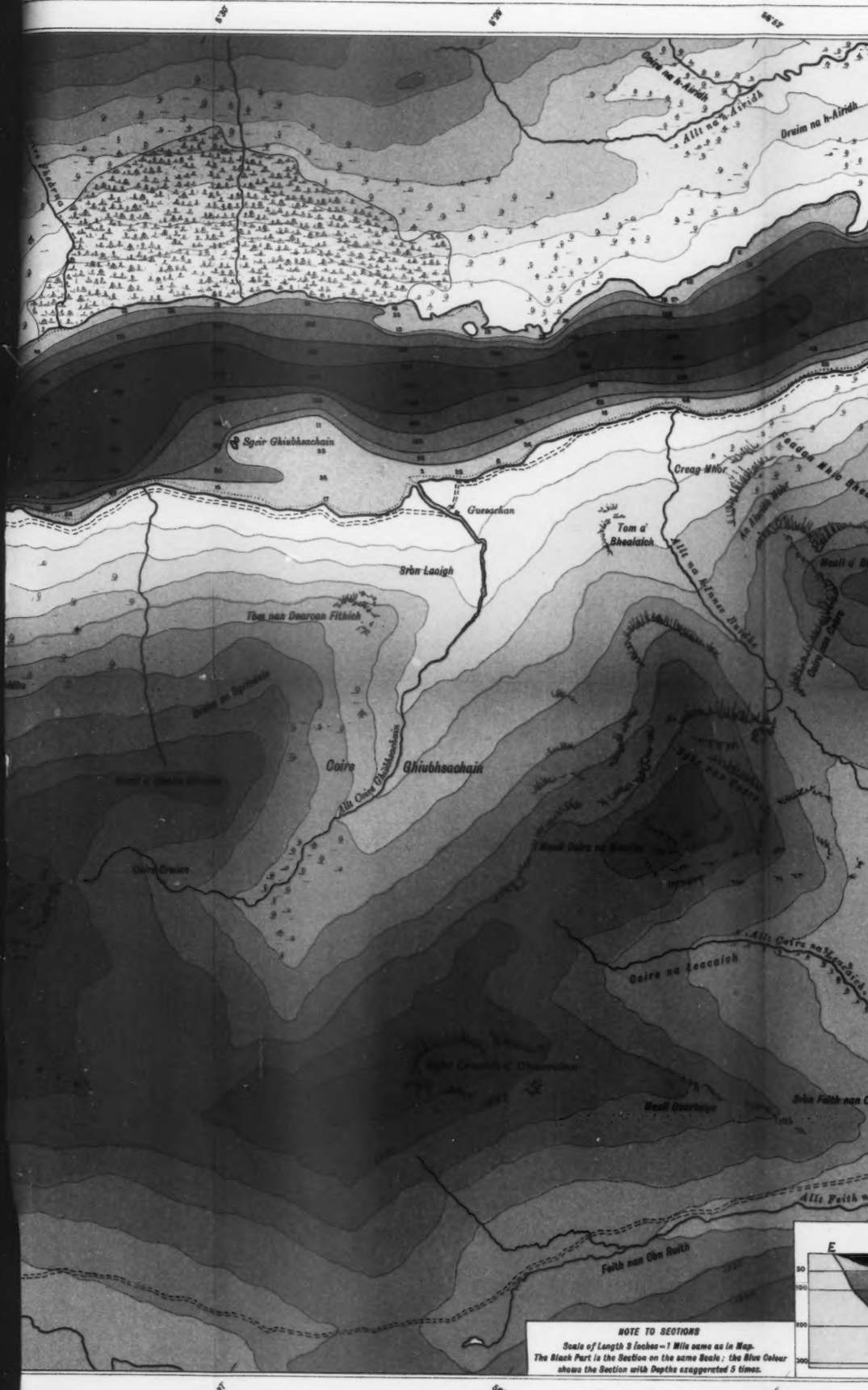
LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH



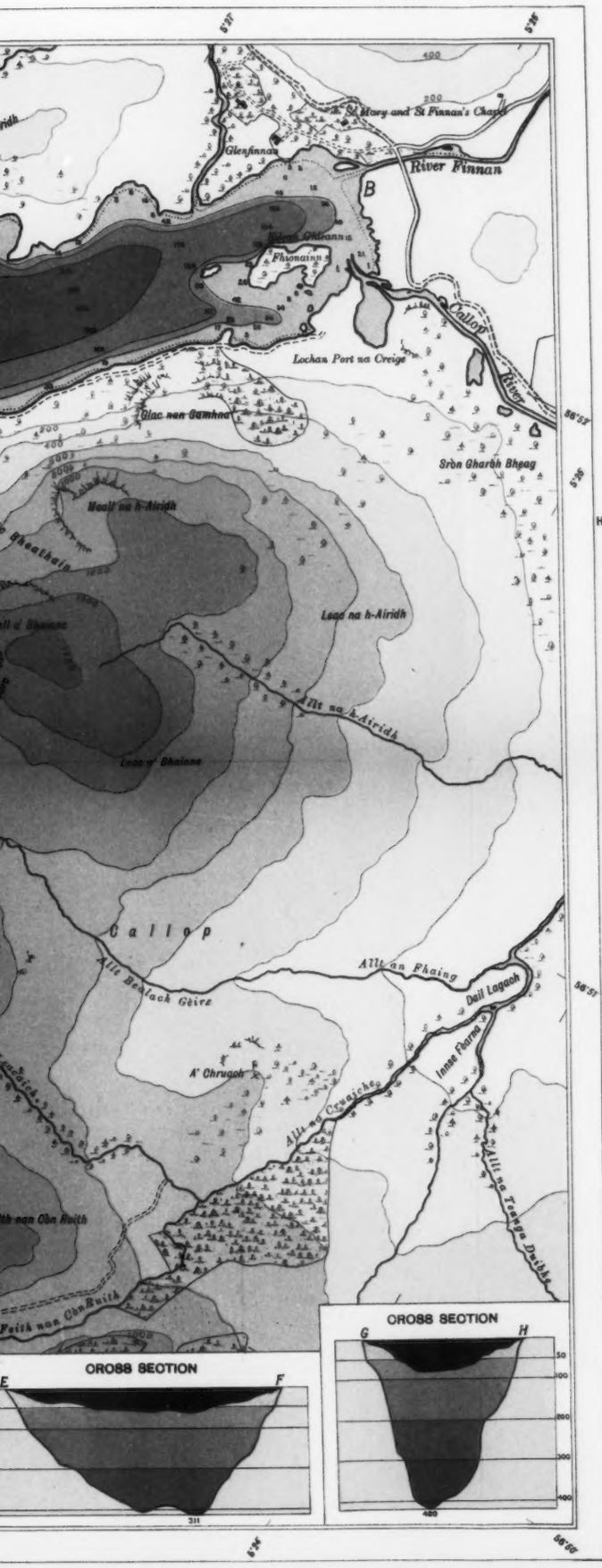
Published by the Royal Geographical Society.

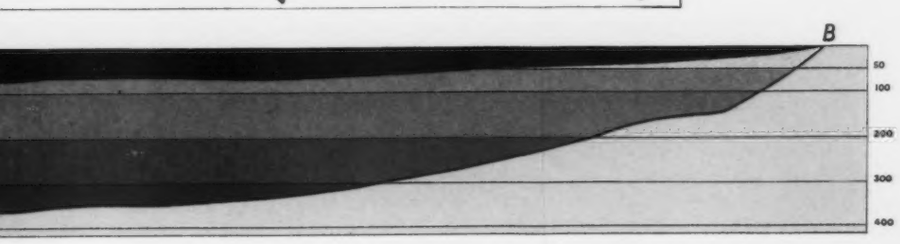
OCHS OF SCOTLAND

F.R.S.E.


Sgoir Ghiubhsachain
Guesachan
Tom a' Bhealaich
Creag Mhor
Srón Laoigh
Tom nan Dearcan Fithich
Coire Ghiubhsachain
Alltan Coire Ghiubhsachain
Coire na Leacaich
Feith nan Gha Reith
NOTE TO SECTIONS
Scale of Length 3 Inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

EPTH



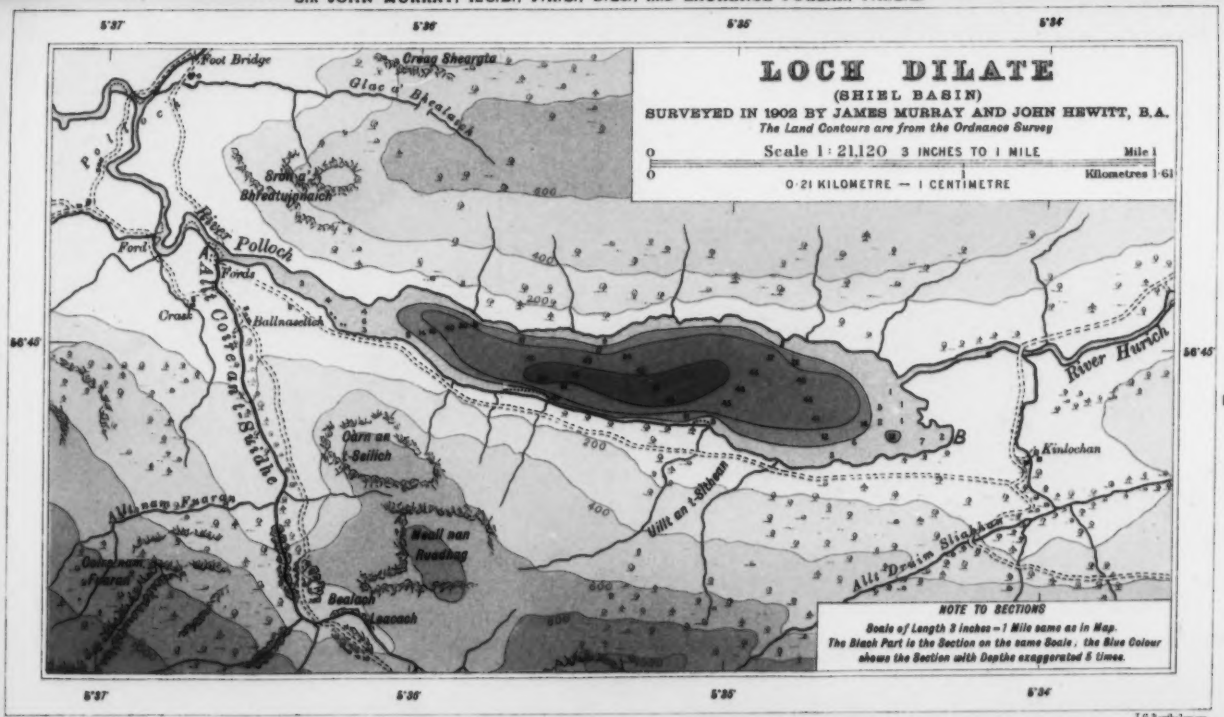


J. G. Bartholomew.

BATHYMETRICAL SURVEY OF THE FRESH-WATER LOCHS OF SCOTLAND

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENCE PULLAR, F.R.S.E.



The Edinburgh Geographical Institute

J. G. Bartholomew

LONGITUDINAL SECTION ALONG AXIS OF MAXIMUM DEPTH

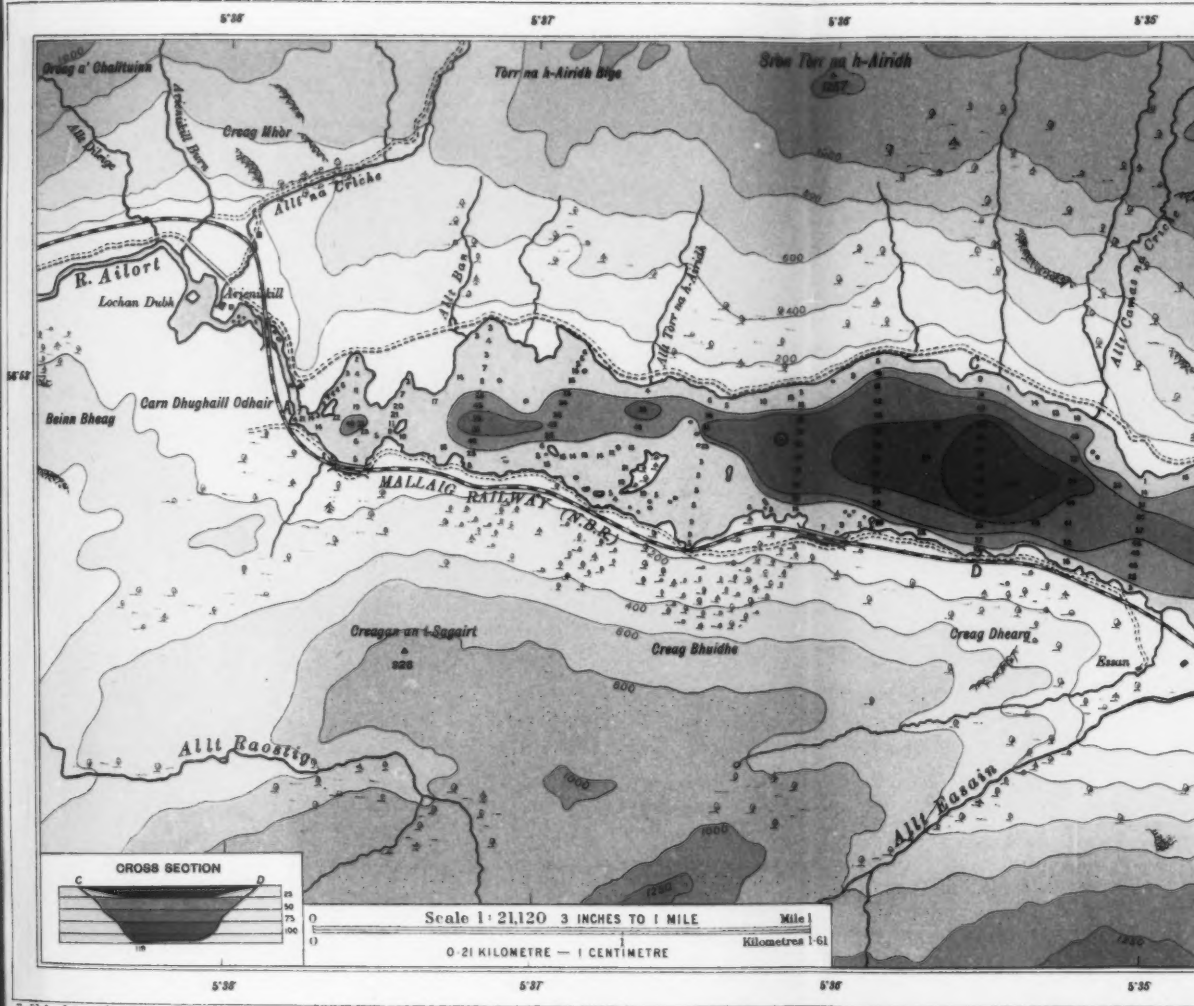
Published by the Royal Geographical Society.

PLATE IV

BATHYMETRICAL SURVEY OF THE FRESH-WATE

UNDER THE DIRECTION OF

Sir JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAURENC



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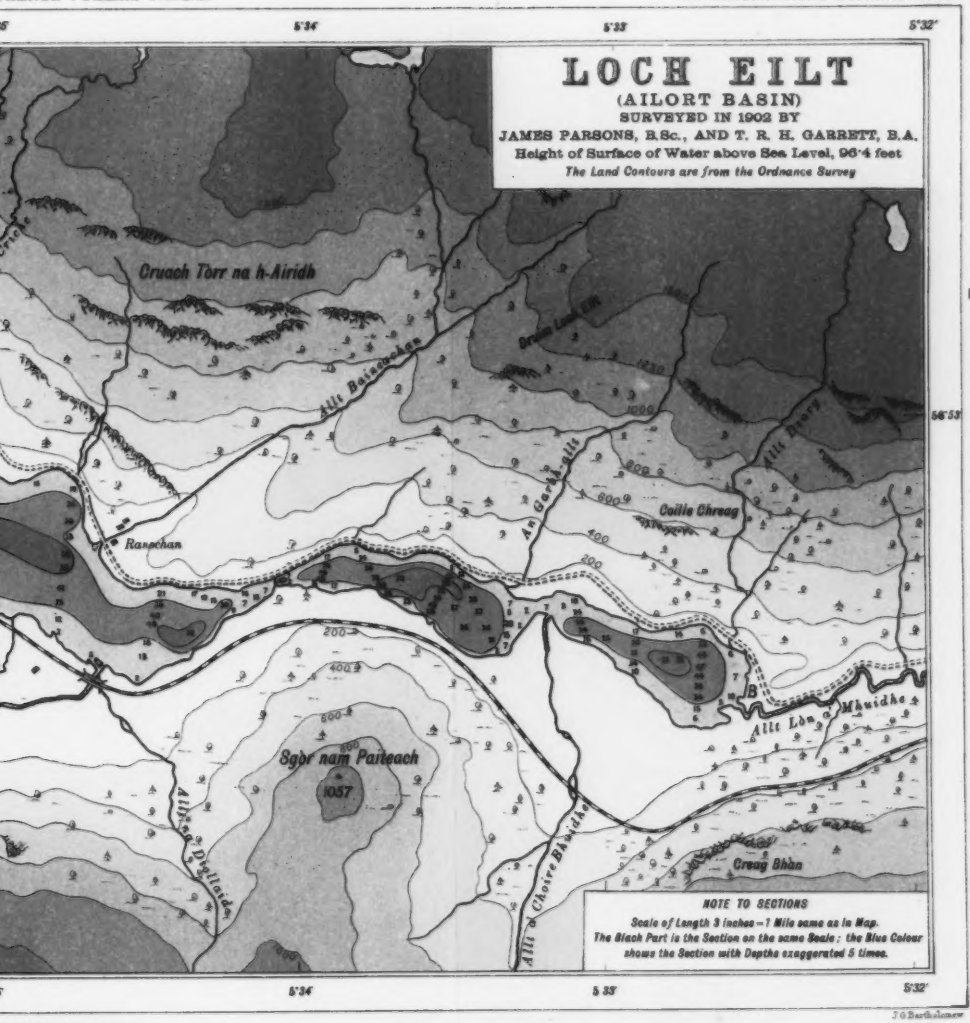
LONGITUDINAL SECTION ALONG AXIS OF MAXI

Published by the Royal Geographical S

RENCE PULLAR, F.R.S.E.



MAXIMUM DEPTH

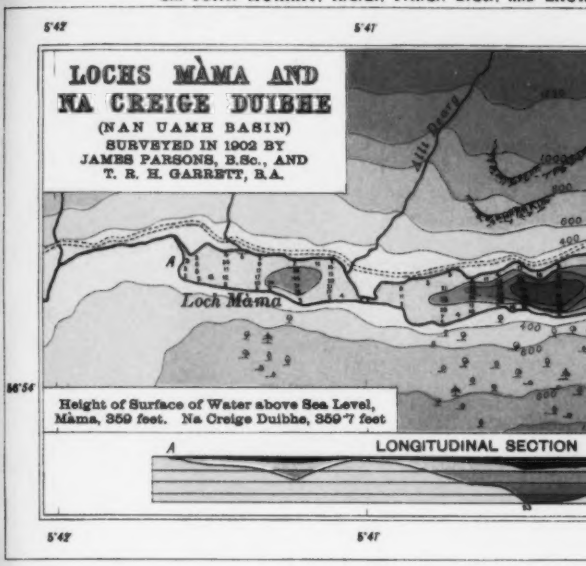
cal Society.

PLATE V

BATHYMETRICAL SURVEY OF THE FRESH-WA

UNDER THE DIRECTION OF

SIR JOHN MURRAY, K.C.B., F.R.S., D.Sc., AND LAUR

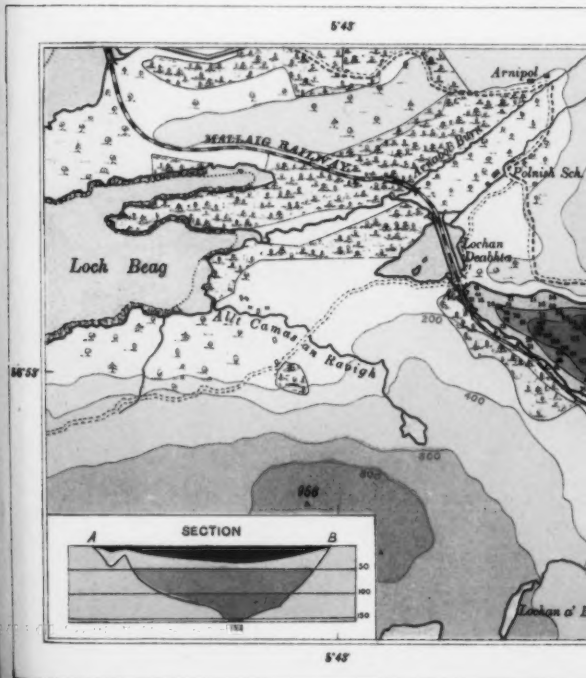


0 Scale 1 : 21,120 3 INCHES TO 1 MILE Mile 1

0 1 Kilometres 1·61

0·21 KILOMETRE — 1 CENTIMETRE

The Land Contours are from the Ordnance

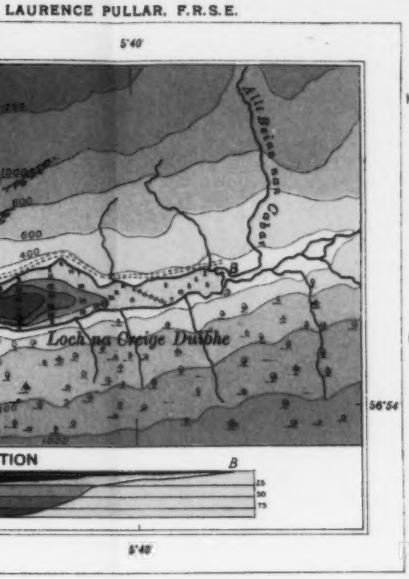


The Edinburgh Geographical Institute

Published by the Royal Geographic

H-WATER LOCHS OF SCOTLAND

OF
LAURENCE PULLAR, F.R.S.E.



HEIGHTS IN FEET

FEET	METRES
1250	381·1
1000	304·8
800	243·8
600	182·9
400	121·9

DEPTHS IN FEET

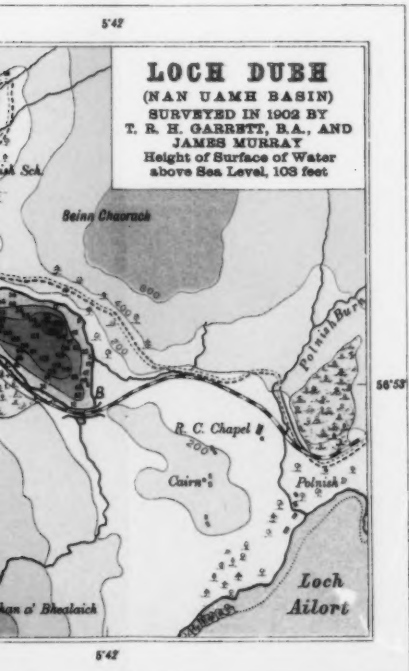
FEET	METRES
25	7·6
50	15·2
75	22·9

NOTE TO SECTIONS

Scale of Length 3 inches = 1 Mile same as in Map.
The Black Part is the Section on the same Scale; the Blue Colour shows the Section with Depths exaggerated 5 times.

61

Finance Survey



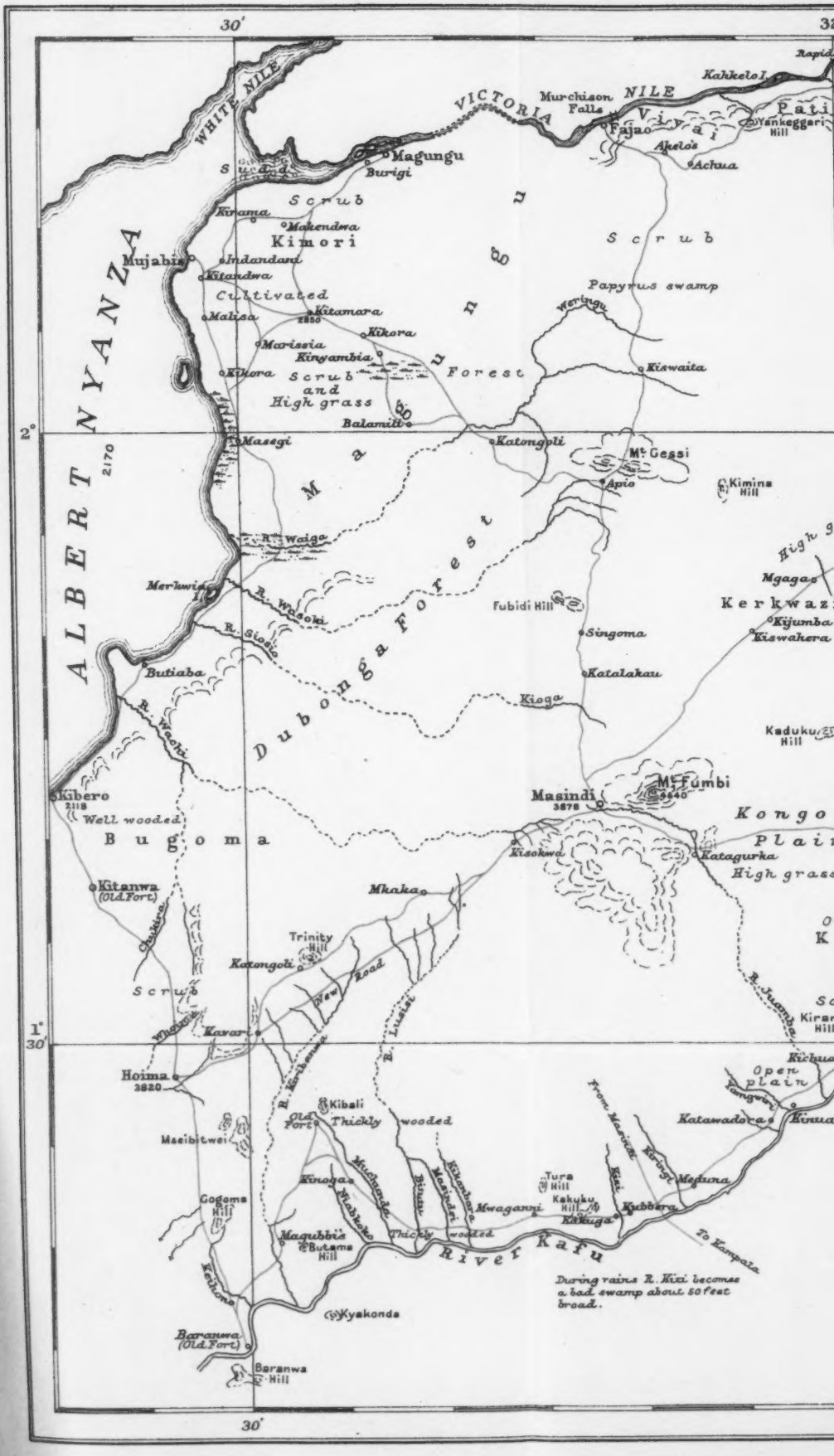
HEIGHTS IN FEET

FEET	METRES
800	243·8
600	182·9
400	121·9
200	61

DEPTHS IN FEET

FEET	METRES
50	15·2
100	30·5
150	45·7

J. G. Bartholomew



Published by the Royal G

NORTH WESTERN UGANDA

SKETCH MAP

of

PART OF

UNYORO

from a route traverse by

Capt. R. C. R. Owen

(4th Kings African Rifles)

1900 - 1901.

Scale 1:500,000 or 7·9 Stat. Miles = 1 Inch

5 0 5 10 15 20 25

The basis of this map is a route traverse with prismatic compass and cavalry sketching board, adjusted to the latest astronomically determined positions. The distances were obtained by pacing, continually checked by intersection. The routes shown are those actually paced, but the country was explored to a considerable distance on either side of the routes. Heights in feet, routes in red.

32° East Long. 30'